Ontario's Environment Today

A newspaper for high school students

1977-1978

Trying to save our resources

In Ontario, each person throws away up to four pounds of garbage per person per day. That's roughly three tons a year for a family of four. Canadian taxpayers spend $500 million a year for its collection and disposal.

A large percentage of this material is disposed of in landfill sites. Unfortunately, especially in urban areas, land which can be designated for this purpose is becoming harder to obtain.

In addition, many of our non - renewable resources, such as tin, aluminum, and even iron, are irreplaceable and available only in limited supply. Even our natural resources, such as wood, can be gobbled up faster than our forests can replace them.

Labelling these resources "garbage" and burying or incinerating them along with other waste material is shortsighted and foolhardy. Often, they can be reclaimed, reused and/or recycled.

For these reasons, the Ontario Ministry of the Environment is now exploring new methods of waste disposal and recovery.

Sanitary landfill

As recently as 1967, half of our waste was dumped in out - of - the - way spots. This practice wasted valuable agricultural land, attracted rodents and other pests, created health and fire hazards, and if located near a watercourse or underground watertable, could contaminate the area's supply of fresh water. Since 1970, when the Ontario government assumed responsibility for water management, almost all of these dumps have been replaced by sanitary landfill sites.

At a sanitary landfill site, a layer of garbage is spread over the area, and when dumping is finished for the day, or the depth has reached two feet, a layer of compressed soil is spread over the top. Sanitary landfill sites are located where they will not threaten water quality above or below ground. The completed site can be used as a park, a golf course, or a playing field.

Incineration

Incineration, another popular method of waste management, is only a partial means of disposal because every incinerator must have a site for the disposal of its ash residues and for the non - incinerable materials it receives. It could also cause some degree of air pollution and again, destroys our resources.

The major advantages of incineration are that it reduces the volume and weight of the waste material substantially, and when properly burned, the ash is sterile and free from organic matter. The final ash can be used as landfill material in construction and for the building of roads.

Resource recovery

Municipal refuse contains metals such as iron, copper, and aluminum. It also contains paper, plastic, glass, and a wide range of organic and inorganic material. Almost all of these materials can be reclaimed for energy or recycling purposes. This is the basic principle behind the Ontario Centre for Resource Recovery.*

The $12 million centre, opened in 1977 in Downsview, is both an operational reclamation plant and a research laboratory for developing efficient, economical means to change waste into new products, and to establish markets for the products. Everyday it receives 800 tons of Metropolitan Toronto garbage, which can be either transferred to long - haul vehicles for transport to landfill sites or processed for resource recovery.

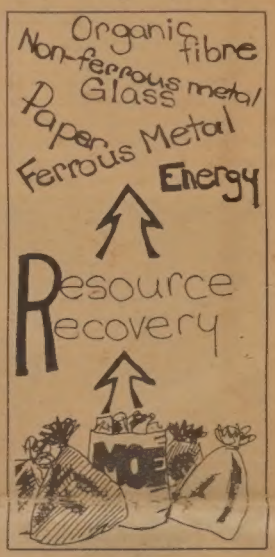
The experimental plant has been designed to meet these three objectives:

— to establish cost and operating efficiency data for the various resource recovery processes:

— to generate working quantities of recovered materials to develop markets for future resource recovery plants; and

— to test new equipment and processes.

Household, commercial, and industrial refuse and solid waste, including bulky and oversized things, such as stoves and refrigerators, are accepted at the resource recovery plant. From these, baled paper and cardboard, ferrous and non - ferrous metal, glass, paper fibre, organic fibre, compost, and energy are produced.



Throughout each process, extensive monitoring equipment and instruments are used to assess each area. As soon as the latest resource recovery equipment is tested, proven effective, and markets developed, additional plants will be built throughout the Province.

From the truck

The garbage collection trucks pass over a weight scale to enter the receiving building. Here, the refuse is compacted for transfer to a landfill site, or sent on to the resource recovery process. Commercial collection trucks, containing mainly corregated cardboard or mixed wastepaper, unload near a special conveyor where the material is hand - sorted and baled for sale to wastepaper users.

The majority of the waste for resource recovery moves along a vibrating conveyor belt where the more salvageable paper materials and potentially hazardous items are knocked off. This conveyor

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Students work for better environment

Over 500 high school and university students were hired by the Ministry of the Environment during the summer of 1977. The students, who worked in both field and office settings, assisted the Ministry's regular staff in their task of protecting and preserving Ontario's natural environment.

Above: A cottager looks on while two summer students, employed in the Ministry's Cottage Pollution Control Program, take water samples from a lake in Central Ontario.

Inside

Man not only source of air pollution Mother Nature also found guilty

Air pollution — we've all heard about it, and most of us have either seen, smelled, or felt its effects. But what is air pollution, exactly?

It is a concentration of impurities in the air sufficient to affect human health or property or the natural environment.

Air pollution poses a threat to health, contributes to an aesthetic degradation of the environment, causes economic losses from damage to vegetation and materials, and can create safety hazards for motorists, because of reduced visibility.

It is caused by both natural and man - made processes. Nature creates air pollution through erupting volcanoes (gases and particulates), naturally decaying organic substances (gases), earthquakes (particulates), sea spray (salt), and forest fires (soot). On a sheer weight basis alone, nature produces more air polluting material than man but she can clean up her own pollution. She cannot, however, cope with man's production of sulphur dioxide and carbon monoxide emissions.

Man began to contribute to the pollution of the atmosphere through his discovery of fire. Smoke, ash and carbon dioxide were all the results of his first campfire. Then he began to chip away at rocks for his tools and bits of powdered stone escaped into the atmosphere. Skinning animals for clothes added more dust and hair. Following this, he derived methods for building homes, making pottery, threshing grain, baking bread and mining and refining metals — more pollution. He has expanded his air polluting prac-

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Adequate sewage treatment essential to protect quality of Ontario's water

The Ministry of the Environment is the provincial agency responsible for water management in Ontario. One of its tasks is to ensure that the water used in our homes and industries is returned to the lakes and rivers in a clean state.

The direct discharge of untreated domestic or industrial liquid wastes into any body of water makes that area unsuitable for practically every use. The water becomes offensive to humans through its odour and appearance, and is a hazard to public health. The cycle of plant and animal life is also disrupted because of the change in oxygen levels.

To prevent this, 97 per cent of the Province's domestic waste is treated at 310 sewage treatment or pollution control plants throughout Ontario. Of these, over 180 plants in the Great Lakes area have been equipped with special phosphorus removal facilities. Phosphorus, a chemical which acts in the same manner as a fertilizer, increases the growth of aquatic plants in a lake or river. The result is an excessive weed growth hazardous to recreational activities and aquatic life. Phosphorus is found naturally in human and animal wastes and in domestic and industrial sewage.

In Ontario, three methods of sewage treatment are used: primary, activated sludge or secondary, and tertiary, depending on the needs of the community and the receiving waters.

The basic sewage treatment process begins in the same manner for each of the three methods. The raw sewage enters through a protective influent screen that removes or shreds large material such as sticks, metal objects, or rubber that could damage the machinery.

The sludge, which remains after sewage treatment, can be used as a soil conditioner.

Primary treatment

It then passes through a grit settling tank. Here the flow is delayed long enough to allow the heavier particles of grit and sand to settle to the bottom of the tank. Periodically, the settled grit and sand is removed and transported to the disposal area.

From the grit settling tank, the wastewater flows into the primary settling tanks where the flow of the wastewater is reduced so that the organic matter can settle to the bottom. This process takes about two hours, and approximately 40 to 60 per cent of the solids are removed. The settled material, called "raw sludge", is removed from the bottom of the tanks and taken to the digesters for further decomposition.

The scum that forms on the surface of the water is removed by a skimming mechanism, and is taken to the digesters.

The partially treated wastewater, now called "primary effluent", flows out of the tanks over a weir into a collector channel. From here it flows into the next section of the plant for further treatment.

Secondary treatment

Primary treatment followed by secondary, or activated sludge treatment, removes 90 to 95 per cent of the original suspended and dissolved material from the wastewater.

After completing the primary treatment process, the wastewater passes into aeration tanks where bacteria break down the remaining solids. Air is constantly forced or bubbled through the water to increase the rate of this process.

Primary and secondary sewage treatment involves the use of aeration (foreground) and settling tanks.

The final result is a muddy deposit or sludge, which can easily be removed. Some of the sludge is piped back to the primary settling tanks to be used as a bacteria starter. (This type of bacteria has no adverse effects on humans.)

The water, now very clear, is chlorinated for 15 to 30 minutes and released into the receiving waters.

Tertiary treatment

The effluent from secondary treatment can create some undesirable effects in the receiving waters because the oxygen and nutrient levels of the effluent may be higher than that of the receiving waters. These discharges can cause an excessive growth of algae and other aquatic plants, altering the natural balance of the existing aquatic life.

To prevent this, a third stage to "polish" the water has been developed, called tertiary treatment. Instead of chlorinating the final effluent after secondary treatment, the wastewater is pumped into a "stabilization lagoon", a water tower, or run through filters. However, no tertiary treatment is typical. This third stage must be adapted to the particular need of the receiving water. In the Stratford sewage treatment plant, tertiary treatment involves running the effluent over four variable declining anthracite and sand filters, each approximately 13 feet by 26 feet, before it is released into the Avon River.

Sludge removal

The excess raw sludge taken from the settling tanks of the primary and secondary treatment facilities is pumped into digesters where it is broken down by anaerobic bacterial action. The end product is thick, black, odorless liquid, which can be used as a soil conditioner or taken to a disposal site.

To reduce the large volumes of digested sludge produced in some plants, the water is removed for easy transport. The de - watering is accomplished with vacuum filters. These large drums, covered with closely spaced coils or cloth blankets, draw the water out of the sludge by creating a vacuum, and atmospheric pressure pushes the water into the drum.

A "sludge cake" is left on the surface that is scraped off, and transported by truck to the disposal area.

During the digestion process, methane gas is produced as a by-product and is collected in the top of the digesters. This gas is used to fuel the plant boilers.

Noise: Caesar had other problems besides Brutus

A bird chirping — is it a sound, or is it noise? If you heard the chirp of a bird in the afternoon, it would probably be enjoyable. But at dawn when you are trying to sleep, this sound turns into noise. Noise is, basically speaking, unwanted sound.

Noise problems have been mentioned throughout man's history. More than 2500 years ago, blacksmithing and cabinetmaking were outlawed in Sybarus, Greece, because of the noise made by the craftsmen. Julius Caesar, in the First Century B.C., banned chariot racing in Rome at night because the sound of the horses' hooves on the cobblestones kept the townspeople awake.

As man developed tools, he also produced more noise. The Industrial Revolution could be renamed the Noise Revolution since the machinery rapidly raised the noise levels. Even today, the amount of noise in our homes doubles every ten years. This increase is caused by the labor - saving household appliances that we use every day, such as dish washers, television sets, clothes dryers, stereos, and vacuum cleaners. Did you know that the food blender in your home has a sound level higher than Niagara Falls?

Noise, like many other things, can be measured. The unit used to measure the intensity of noise is a decibel named after Alexander Graham Bell. The decibel scale is a non - linear one. You don't count 1 - 2 - 3 - 4 - 5 - 6; the decibel scale is logarithmic and would more appropriately be counted 10 - 100 - 1,000 - 10,000. An increase of 1 decibel or dB is equivalent to an increase of 12 per cent in the intensity of a sound; 2 dB = 25 per cent, and so forth up to a 6 dB increase that represents a doubling or 100 per cent increase in sound intensity. 0 decibel is the threshold of hearing; the rustle of a leaf may be about 10 decibels.

Here are more examples to consider:

0 dB - threshold of hearing
10 dB - just audible
30 dB - soft whisper
50 dB - typical business office
68 dB - vacuum cleaner, 10 feet away
78 dB - alarm clock
85 dB - outboard motor
110 dB - construction noises
120 dB - police siren, 100 feet away
145 dB - jet plane takeoff

Health hazards

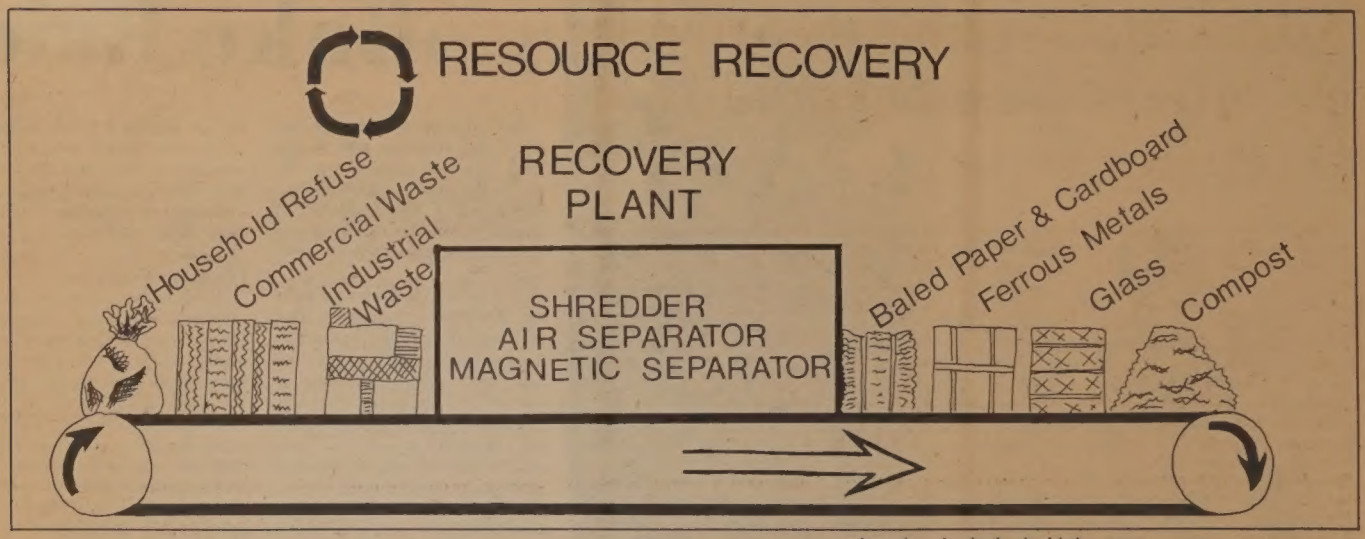
Unwanted sound varies from person to person, but one thing is certain: physical damage will occur if a person is exposed to intense noise over a period of time, and this damage is irreversible. One investigation revealed that ten teenagers suffered an average of an 11 decibel temporary hearing loss after attending a rock concert, and one person had a 35 decibel hearing loss. Permanent hearing losses approximately equal to those found in a 60 year-old man have been measured in a five-man group of performers, all under the age of 23. Excessive noise can also cause partial and total deafness, affect heart disease, ulcers, and hypertension.

The decibel scale, and the possible damage, is as follows:

0 dB - threshold of hearing
20 dB - faint whisper
40 dB - moderate speech
60 dB - loud voice, irritating
80 dB - very loud shouting, ears hurt
100 dB - slight deafening
120 dB - physical damage
150 dB - permanent hearing loss
155 dB - burning of the skin
180 dB - death

Loud sounds once served to warn man against danger. Today, the world grows louder by one decibel per year, and noise has become detrimental to man's health and wellbeing.

12,000 years ago, Mr. Ogg complained to the Mrs. about Junior's drums. The complaint fell on deaf ears. *What noise do you hear about your place?*



Resource Recovery

(Continued from page 1.)

leads to a shredder which can reduce refrigerators, stoves, tires, and other material to six inches in size.

The shredded material then enters an air separator where a three - thousand - foot - per - minute upward air stream lifts shredded paper and plastic film from the other wastes. This light fraction of material is blown into large bins for future use, either as an energy source to heat the experimental plant, or for the recovery of paper fibre.

The heavy material, including shredded metal, glass and food wastes, is conveyed to the commodity recovery building, where an electro - magnetic separator removes the ferrous metals, shreds them again and stores them for further shipping.

The remaining heavy material passes through a manual separating station to recover any non - ferrous metals such as aluminum and brass. The waste material then enters a revolving screen where the crushed glass and ceramics are filtered out through quarter - inch mesh openings. The glass fraction is stored in bins for future shipping to glass manufacturers or secondary industries.

The oversized material left from the revolving air separator is finely ground and fed into yet another air separator to recover any organic matter, which is conveyed to a storage bin. The organic material is used either for energy recovery, or is transferred to the compost section for composting.

In this section, the organic material is mixed with sewage sludge and fed into the composter. Here, the material is broken down into a good soil conditioning mix, which is later marketed or used in land reclamation.

Watts from waste

Another method for making the best use of our garbage is the Watts From Waste project, developed jointly by the Ministry of the Environment and Ontario Hydro.

The $23.2 million experimental plant, located in Toronto, will initially process 1,000 tons of garbage a day to produce 500 tons of fuel, when it opens in 1980.

This fuel, produced when the garbage is pulverized, air dried, magnetically separated and pulverized again, will be used as a supplementary fuel for burning with coal at Ontario Hydro's Lakeview Generating Station. The metals recovered in the magnetic separation process will be sold to a steel company for recycling.

It has been estimated that converting the garbage to fuel instead of transporting it to sanitary landfill sites will produce a saving of $900,000 a year.

If the program is successful, the plant will expand to convert 1,600 tons of Metropolitan Toronto garbage a day into 1,200 tons of fuel.

**Tours of Ontario's experimental Resource Recovery Plant in Downsview can be arranged by calling (416) 636-8015.*

Points to ponder

— by 1980 , it is expected that North America will generate 350 million tons of solid waste a year.

— in Canada, the average person produces four pounds of garbage each day and pays about $25.00 a year in taxes to have it collected. Ontario alone generates eight million tons each year.

— to get ready for the 1976 Winter Olympics in Denver, Colorado, acres of green land were torn up for parking lots, 25 acres of trees were felled for the bobsled run, and an eight foot wide strip of land, 55 miles long, was cleared for the cross - country ski trail.

— it is estimated that 50 million acres of land has been destroyed by soil erosion.

— about 450,000 cars are junked annually across Canada.

— each year, Canadians throw away about three billion bottles and jars, five billion cans, and five million tons of paper.

12,000 years ago, Mr. Ogg invented the fly swatter. It was scarcely a smashing success. *What do you use for pest control?*

12,000 years ago, Mr. Ogg took his family for a Sunday drive and invented a pollution control device. *Have you checked your car lately?*

Noise

(Continued from page 2.)

Anti-noise laws

Municipalities have the authority through the Ontario Municipal Act to pass local bylaws covering "unusual noises, or noises likely to disturb the inhabitants", and to provide a penalty of up to a $1,000 fine. However, few have actually done so.

The Ontario Ministry of the Environment has developed extensive programs to help abate noise problems and has prepared a Model Municipal Noise Bylaw to assist municipalities in regulating noise.

North Bay was the first Ontario community, as of August 1977, to put a noise bylaw into effect based on the model prepared by the Ministry. The new bylaw allows the City Council to prohibit entirely certain types of disturbing noises, such as the use of ineffectively muffled vehicles, and the operation of noisy construction equipment in a "Quiet Zone". The City Council may also prohibit, by time and place, a variety of noisy activities such as the use of fireworks, the discharge of firearms, the operation of car washes, and the barking of dogs.

There are thirty other municipalities preparing bylaws based on this Environment Ontario model and four of these bylaws, for Hamilton, Guelph, Barrie and Lakefield, are awaiting final Ministry approval.

This is a step towards a less noisy world, but its success depends not only on the co-operation among governments, but on the individual and his noise - reducing activities.

Individual responsibility

You can help reduce noise by just having some consideration for others. Don't drive a "hot" car or motorcycle — the only attention you get is from the noise you produce. Urge your parents to have their car tuned. If an industry in your area is making too much noise, complain to your town official. If you play in a group, turn down your amplifiers before they blow your mind. Keep the stereo down, too. At the cottage, keep the boat docked early in the morning and late at night, so you won't disturb other vacationers. Voices travel well over water, so keep your voice down. Don't mow the lawn early in the morning or late in the evening, and don't try to talk over your neighbor. Above all, be tolerant of others — what may be sweet sounds to you may be pure noise to them.

Lake Erie

There is a high demand for recreational facilities on Lake Erie.

During the last decade, up to five thousand commercial vessels and countless pleasure boats used the Great Lakes.

Several years ago, environmentalists and scientists told us that Lake Erie was dying. However, due to the close attention and co-operation of the residents of Canada and the United States, we now have hope for its future revival.

The Lake Erie Basin is one of the world's largest and fastest growing urban - industrial areas. Its population is well over 12 million. One person in three in Canada, and one in six in the United States, is within flushing distance of this Great Lake. The Basin also provides a home for over 400 industries including steel making giants, oil refineries, auto makers, aluminum plants, food processors, and chemical paper and rubber plants.

The waters of Lake Erie are used for municipal and industrial water supplies, cooling purposes, recreation, navigation, commercial fisheries and wildlife. In addition, these same waters are used for domestic and industrial wastewater disposal.

However, Lake Erie is the shallowest of all the Great Lakes and this multi - use demand of its waters led to a deterioration of its water quality at a much more rapid rate than in the other lakes.

Sewage treatment

The first water quality survey of Lake Erie was taken in 1918. The pollution which was discovered at this early date was attributed to the growing towns and cities on the lake that were pouring raw sewage into the water. During World War I and II, some communities built sewage treatment plants that performed the basic cleaning process of removing the solid matter from domestic and industrial wastewater before it was dumped back into the lake. This is called primary treatment. Later, secondary and tertiary treatment plants, capable of removing up to 95 per cent of the solid matter found in waste water, were developed and constructed.

Today, all communities in Ontario have sewage treatment facilities.

Phosphorus

Another major concern of environmentalists, with regard to Lake Erie, was the level of phosphorus found in the water. This nutrient present in human and animal wastes and in detergents made in the 1950s, increases the growth of aquatic plants. The weeds then clog the waterway, reduce the level of oxygen required by fish, and speed up the eutrophication or aging process of the lake.

According to the Federal Department of Energy, Mines and Resources, city sewage discharged directly into the Lake in 1969 accounted for ten per cent of the total phosphorus deposited. A much larger amount, 55 per cent, was from municipalities that dumped treated sewage into the Lake's tributaries. Since then all sewage treatment plants, in Southern Ontario, have been equipped with phosphorus removal equipment.

Other concerns

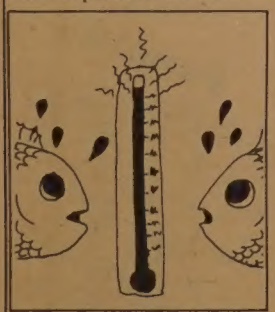
In addition to the problems associated with wastewater treatment, Lake Erie is also affected by sediment build-up, shipping, weeds and erosion.

At its deepest point, Lake Erie is only 210 feet. The average depth is 58 feet, so its harbor entrances and shipping channels require regular dredging. The dredged material is taken to the middle of the lake and dumped. It usually contains large amounts of oil, iron, grease, toxic materials, and oxygen - consuming substances. The new basins then attract fresh sediment by acting as settling tanks for any additional solid material.

Fish find heated water hard to swallow

What would happen if you put a lake trout in a heated swimming pool? The fish would turn belly - up and die because the water was too warm to hold enough oxygen for it to breathe. The same thing happens when heated water from an industry is permitted to flow directly into a lake or river.

Heat is not commonly thought of as a pollutant, but it can be as dangerous to aquatic life as the addition of poisonous chemicals.



Thermal pollution results from the use of water as a coolant in industrial processes such as steel mills, energy power plants, and factories. In 1974, over 75 per cent of all water used in Canada (12,215 million gallons) was diverted each day by industries and thermoelectric power plants for manufacturing and cooling purposes. Over half of the water diverted for industrial use served as a coolant, and most of it was returned to the original source.

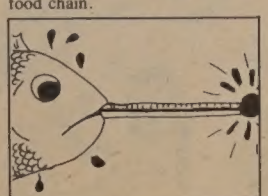
The temperature of the coolant water, when it is returned to the receiving water, can often be heated up to 20 degrees F over that of the receiving water. This causes the vibration of the water molecules to increase, forcing out the dissolved oxygen and lowering its level of concentration. The increase in temperature also 1) increases the rate of chemical reactions, including respiration, 2) gives the aquatic life false temperature cues, and 3) can reach the lethal temperature level of a variety of fish species, resulting in massive fishkills.

Temperature effects

When warm water is added to cooler water, the two separate. The warm water, which can hold only low levels of dissoved oxygen, rests on the top and forms a blanket preventing the atmospheric oxygen from being absorbed by the cooler water. Gradually, the aquatic life in the lower, cooler layer consumes and depletes the available oxygen. Some types of aquatic life then find it difficult to survive.

A common rule among scientists is that for every temperature increase of ten degrees C (18 degrees F), the rate of a chemical reaction, including oxidation and respiration, approximately doubles. In thermally polluted water, fish require more oxygen to breathe because their rate of respiration increases, yet the warmed water holds little dissolved oxygen. Thus, massive fish kills could result.

The life cycles and natural processes of aquatic life are geared to the water temperature, and hence can be completely altered by artificial fluctuations. For an example, it takes 165 days for trout eggs to hatch in 37 degrees F water. If the temperature is raised to 54 degrees F, only 32 days are required; no eggs will hatch above 59 degrees F. This can be disasterous to fish populations. If the eggs hatch too soon and there are no natural food organisms around, the young fish soon die. A reduced number of species also affects the natural food chain.



Fish are able to acclimatize themselves to small, slow temperature changes, but all fish species have an upper, or lethal temperature which kills them. Normally, a moderate temperature change over a 30 - 40 hour period can be tolerated.

Another threat to aquatic life is the chlorination of the cooling water before it is released into the stream. This prevents weed and algae growth in the pipes, but it also kills the micro - organisms in the receiving water that serve as the basis for many food chains.

Solutions

Some industries have incorporated cooling towers into their industrial processes to remove the heat from the coolant before it is returned to the natural water supply. In wet cooling towers, the water is run over baffles in a thin layer. Cool air, entering at the bottom, circulates upward, and removes the heat from the water. In dry cooling towers, air is forced by fans over water - containing pipes, and the heat is exchanged by radiation and convection from the pipes.

Other alternatives are cooling ponds and lakes, where the warmed water sits until it cools naturally to the temperature of the receiving water.

Although heated water is used to keep some harbors ice-free in the winter months, there are few practical applications for its use at present.

well on the road to recovery

During the last decade, up to five thousand commercial vessels were using the Great Lakes — St. Lawrence Seaway system every year. Most of these vessels were equipped with marine toilets, but few had holding tanks or treatment facilities. The large number of pleasure boats also lacked holding tanks. Since 1969, Ontario, New York, and Michigan have introduced legislation requiring all pleasure boats to be fitted with toilets and holding tanks. This has had some positive effects on controlling the dumping of raw sewage into the lake. However, regulations have yet to be made regarding large, foreign commercial vessels, due to the international range of these ships.

Heavy boating near the shoreline has caused two other pollution problems. Weeds can be uprooted by the boat propellers, and they die and rot, contributing to the eutrophication or aging process of the lake. The shoreline is also eroded by heavy wave action from the boats. This erosion causes fine particles of soil to settle on the lake floor, destroying spawning beds and killing aquatic animal and plant life. The process is known as silting.

Water quality agreement

Canada's relations with the United States concerning transboundary waters and air are dealt with through the International Joint Commission (I.J.C.). The I.J.C., a permanent international body consisting of three American and three Canadian representatives, was established through the Boundary Waters Treaty of 1909.

At the request of the governments involved, they investigate air and water pollution along the international boundary. The I.J.C. reports all facts, circumstances, and makes recommendations. It is not a decision - making body. Subsequent decisions and actions depend on the federal governments, and the appropriate agencies, such as the Ontario Ministry of the Environment.

The 1972 United States - Canada Great Lakes Water Quality Agreement, which is currently being updated, was the result of recommendations made by the I.J.C. The Agreement consists of a schedule of specific water quality objectives designed to protect all uses of the lakes waters, a comprehensive pollution control program for both sides of the boundary and provision for a continual monitoring of the Great Lakes by the I.J.C.

Achievements

In summary, while there have been many administrative delays in the municipal wastewater treatment program in the U.S. and not as rapid action as had been hoped for in other programs on both sides of the border, some progress has been made.

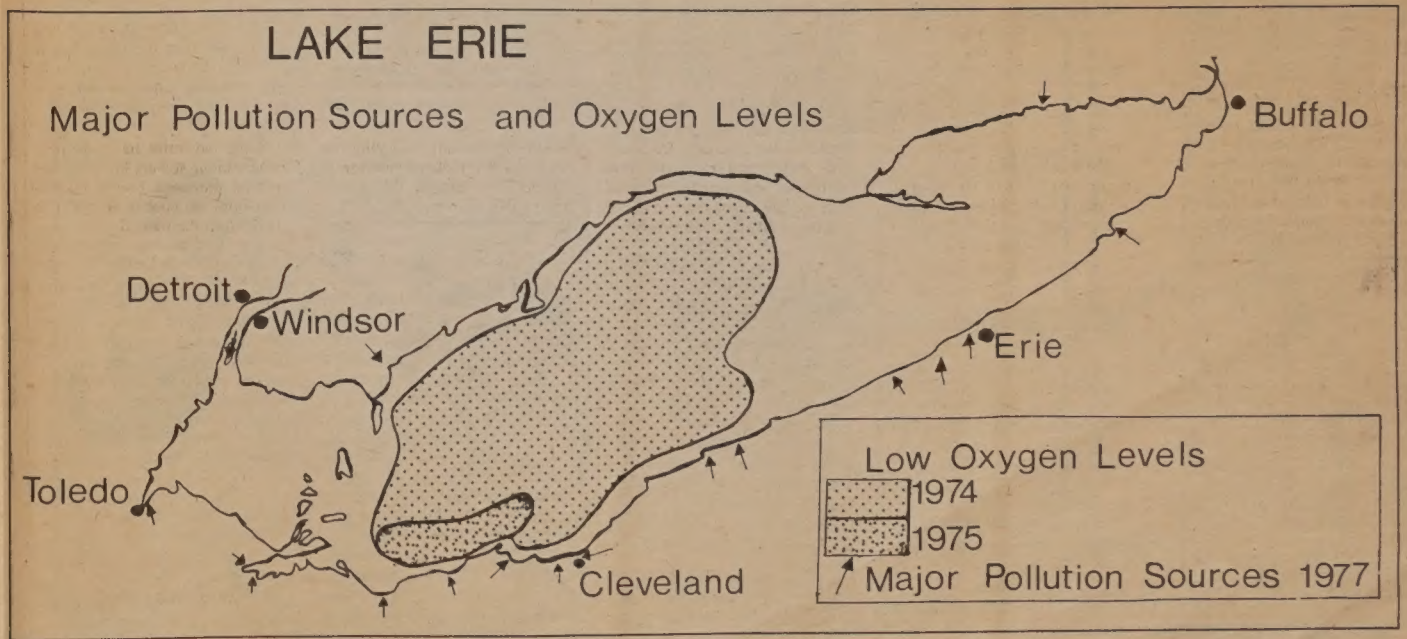
The I.J.C. now reports that the degradation of the water quality of Lake Erie has been halted, and that improvements in nearshore zones are now evident.

In comparing the 1976 water quality with previous years, however, we do find that there was little improvement during that year, but this could again be the result of a recent increase in population and industrial loading.

However, stabilization of the water quality enforces the fact that it cannot be compared year - to - year, but rather over a long period of time.

We are now confident that through the continued actions of both Canada and the U.S. that Lake Erie is well on its way to recovery.

Environment Ontario staff monitor Lake Erie on a regular basis. Here, a man uses a water column sampler to take a representative sample of water at various depths at this station.



MERCURY: from industrial processes to environmental hazard

Mercury, a naturally occurring heavy metal found in most soils and rocks, is used in some industrial processes. It has the ability to dissolve other metals and is toxic both as an element and in many of its compounds. It has, however, only recently emerged, along with a series of other unusual contaminants, as a serious environmental and health hazard.

The most common ore of mercury is cinnabar, and in its reduced form, vermillion. Both of these ores were used by the ancient Romans as a pigment. The Chinese considered mercury as a life prolonging drug, while the Hindus used it as an aphrodisiac. The toxicity of mercury was also known: in Greece, Galen and Hippocrates warned of its poisonous nature, while Pliny described mercury poisoning in slaves that worked in the mercury mines.

Methylmercury

In recent history, the first reported deaths caused by mercury poisoning were in 1865 when two lab assistants died. Methylmercury, a common organic mercury compound was found in their body tissue. Symptoms of mercury poisoning in humans, of which methylmercury causes the worst, include numbness and loss of co-ordination in the hands and feet, a loss of control over the vocal chords, and tunnel vision. Methylmercury attacks the entire nervous system and causes physical degradation of the tissue. In some autopsy findings, portions of the brain have actually been destroyed.

The general public was not aware of the effects of mercury until mercury poisoning occurred in the City of Minimata, Japan, in 1953. In 1949, an industrial complex on the Minimata Bay began to produce chemicals that used mercury as the catalyst. During the process, part of this catalyst was converted into a mercury compound, methylmercury, which was discharged into Minimata Bay. The methylmercury accumulated in the fish and shellfish, which were caught by the local fishermen. Cats were the first to be affected: they couldn't walk, screamed, went into convulsions, and even threw themselves into the sea. Soon, people began to report numbness in their legs and arms, loss of co-ordination, impairment of vision, hearing and speech, and sometimes death.

Doctors named it "Minimata Disease", but it wasn't until 1959 that the cause was discovered. In 1964, Japanese researchers demonstrated that the mercury catalyst had been converted to methylmercury in the chemical plant. By then, 12,000 cases of Minimata Disease had been diagnosed, and over 100 people were dead.

In the late 1960's, Swedish scientists discovered that metallic, phenylmercury, and organomercury, all mercury compounds, could be converted into toxic methylmercury by naturally occurring micro - organisms in the sediments of lakes and rivers. Since most mercury compounds are not soluble in water, they settle in the lake or river bed, and there they are attacked by the micro - organisms causing the conversion.

The fish take in methylmercury through their food and when the water passes over their gills. Methylmercury builds up progressively in the fish flesh because it binds with a sulphur group present in fish protein. The bond is very stable — it cannot be removed by cooking, and it is not eliminated from the fish body. Because of their eating habits, large predatory fish, such as pike, walleye, lake trout, or bass have the highest mercury concentrations.

Sources

When the Swedes made their discovery in the late 1960's, Canadian scientists in 1969 began testing fish for mercury in waters that were receiving effluents from mercury - using industries. The main industries, which use mercury, are chlor - alkali plants in the preparation of chlorine and caustic soda.

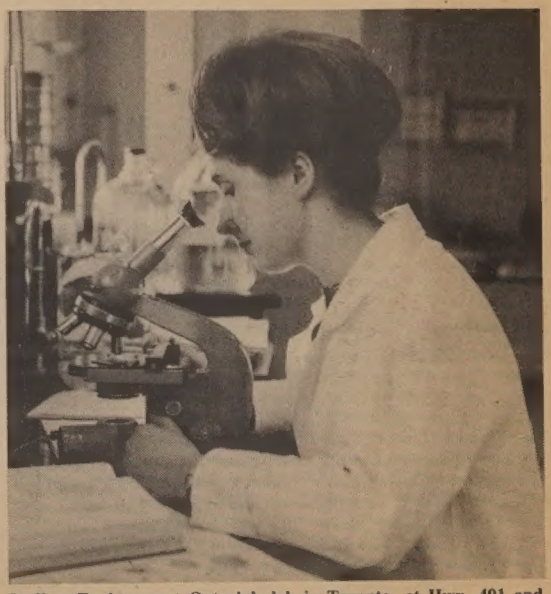
In 1970, the Ministry of the Environment issued control orders to the six chlor - alkali plants in Ontario, demanding the curtailment of their mercury losses. As a result, four plants have shut down, the fifth will close in 1978 and the sixth now meets the mercury discharge guidelines.

Although emissions of mercury have been drastically reduced, the dissipation of the mercury content in the water depends on the size, flow, location, and type of water body involved. For example, since Dow Chemical of Sarnia stopped its mercury discharges, the mercury levels in the fish from the fast - flowing Lake St. Clair have dropped to less than a quarter of what they were in 1970 and it is predicted that by 1987 commercial fishing will be permitted to resume.

In the Wabigoon - English River System, the concentrations of mercury in fish have been the highest of any fish found in North America — in Clay Lake, some large yellow walleye have concentrations higher than 25 parts per million (ppm) — fifty times the concentration recommended as safe for human consumption.

The mercury levels of fish in this system are not dropping as rapidly as in Lake St. Clair because new bottom sediments do not cover the mercury contaminated sediments in the Wabigoon - English River System as quickly as they do in Lake St. Clair.

Other industrial sources of mercury, in addition to the chlor - alkali plants, include pulp and paper mills, gold and silver mines, electrical manufacturers, and hospitals. It is used in some paints, and in preparation of dental fillings. In addition, mercury has been found in fish, far removed from industrial activity because of its natural presence in mineral deposits.



Staff at Environment Ontario's lab in Toronto, at Hwy. 401 and Islington, check fish samples for mercury concentrations.

Lake surveys

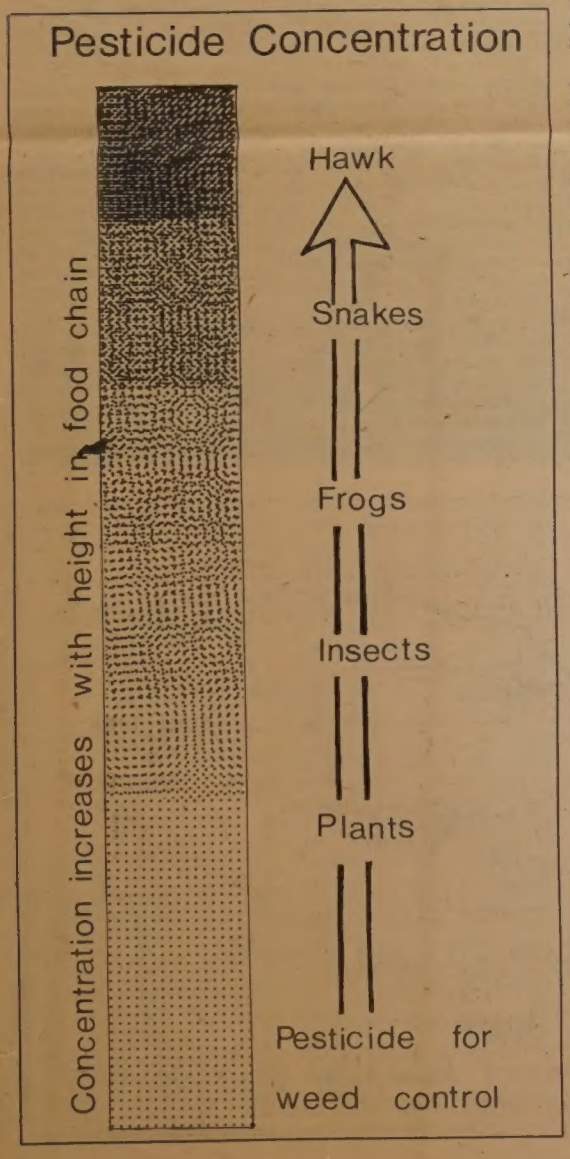
In Ontario, the Ministry of the Environment and the Ministry of Natural Resources have a joint program for surveying lakes to determine the levels of mercury in the fish. To date, approximately 40,000 fish from almost 200 lakes have been sampled and tested. The survey plans for 1977 have been expanded to include over 116 inland lakes and rivers, and 37 areas on the Great Lakes. In all, it has been estimated that over 11,000 fish will be analyzed in 1977.

When fish are tested for mercury contamination, it is usually the predator species that are examined; if there are low mercury levels in the predator species, it is more than likely that the other species will have low levels too. Using nets, it is quite easy to catch pike, walleye, or lake trout. But the Ministries have asked the co-operation of Cottagers' Associations to catch bass samples, which are usually caught only by angling.

In Ontario, mercury contaminated fish with levels under .5 ppm can be consumed without restriction. Fish with levels .5 ppm to 1.5 ppm should be consumed only occasionally, but anything over .5 ppm should not be consumed by women of childbearing age or children under 15 years of age. Mercury contaminated fish above the level of 1.5 ppm should not be consumed at all.

The Ministries of the Environment and Health have also published a report, which lists the lakes already sampled and recommendations for the frequency of eating the fish, according to size and species, from these areas. By September, 1977 each of these lakes should also have a sign posted regarding consumption.

A booklet, entitled "Guide to Eating Ontario Sportfish", is now available from the Information Services Branch, Ministry of the Environment, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5.



12,000 years ago, Mr. Ogg thought his drinking water tasted funny.
Do you protect our water supplies?

12,000 years ago Mr. and Mrs. Ogg received the first air pollution complaint. *Are your neighbours breathing easy?*

Air

(Continued from page 1.)

tices today through factories, motor vehicles, heating devices, electrical generators, and incinerators.

Man's activities

Three man - made processes which can cause air pollution are: 1) combustion, 2) vaporization, and 3) mechanical attrition.

Since man discovered fire, he has built our society and technology on the combustion, or burning of fossil fuels. The by-products of incomplete car engine combustion — smoke and gases — are the primary sources of air pollution in the large, urban centres of North America.

Vaporization, or volatilization, is a by - product of many chemical and manufacturing processes. By quickly vaporizing compounds, such as acids, tiny droplets of the acid are released into the air with the evaporated liquid, and are dispersed into the atmosphere, contributing to air pollution.

Mechanical attrition includes crushing, grinding, drilling, sweeping, sanding, pulverizing, atomizing, and other similar operations that disperse particulate matter in the form of dust or mist into the air.

Particulates and aerosols

Air pollution can be divided into two types: particulates and aerosols found in mists and dusts, and organic and inorganic gases.

Particulates, tiny flecks of ash, dust, and solid matter, are responsible for human respiratory ailments, damage to clothing, property, and vegetation, soiling and corrosion. They may also contain cancer - causing and radioactive materials.

Aerosols, released into the atmosphere through sprays or emitted through the fracturing or the decomposition of large particulates, tend to remain suspended permanently in the air. They can be organic or inorganic in composition, and either liquid or solid. Aerosols may be inhaled with air, and may also reduce visibility through the process of light scattering.

Gases

The second type of pollutants — the gases — can be divided into the organic or inorganic types. Among the organic pollutants are hydrogen carbon compounds, or hydrocarbons, and their derivatives.

The main source of hydrocarbon emissions is the gasoline - fueled motor vehicle. When there is sufficient oxygen, complete combustion of hydrocarbon fuel produces only carbon dioxide and water vapor. However, when incomplete combustion occurs because of, for example, the poor mixing of air and fuel within the engine, many additional and dangerous gases are produced. These include carbon monoxide, oxides of nitrogen, lead, and unused hydrocarbons.

The major inorganic gases, produced during industrial and commercial processes, domestic transportation, space heating and power generation, are oxides of 1) nitrogen, 2) sulphur and 3) carbon monoxide.

1. There are many oxides of nitrogen but only nitric oxide (NO) and nitrogen dioxide (NO^2) are important as air contaminants. When nitrogen oxides are released into the atmosphere, through automobile emissions, they react with sunlight and oxygen to produce nitrogen dioxide, the major ingredient of photochemical smog, or "Los Angeles Smog", which makes your eyes tear.

2. Only two oxides of sulphur — sulphur dioxide (SO^2) and sulphur trioxide (SO^3) — are classified as air contaminants. They are produced mainly from the combustion of oil and coal — fuels which contain sulphur. Both these gases have a characteristic pungent odour, and this type of pollution is known as "London Fog".

All oxides, when combined with water, form acids which can corrode metal surfaces, fabrics, and plant leaves, along with being harmful to human health. Gaseous sulphur oxides combined with water vapor or mists form an irritating sulphuric acid mist. In concentrations as small as five parts per million, sulphur dioxide, combined with atmospheric water vapor, is irritating to the eyes and respiratory system.

3. The oxide, carbon monoxide (CO), is another product of incomplete combustion. Automobiles contribute as much as 97 per cent of the total amount of carbon monoxide in large metropolitan areas.

Carbon monoxide is clear and colorless, but it has a high affinity for haemoglobin which transports the oxygen in the bloodstream. Thus, carbon monoxide can reduce the oxygen supply to the body tissues, causing headaches, and, if highly concentrated, death.

Monitoring programs

Air management in Ontario is the responsibility of the Ministry of the Environment through the 1971 Environmental Protection Act, and its regulations. Under this Act, the Ministry inspects and regulates all possible sources of air pollution. It establishes air quality objectives and emission standards in Ontario, and conducts monitoring programs throughout the Province. It also conducts meteorological studies, and research into pollution abatement methods such as separators, wet collectors, electrostatic precipitators, incinerators, condensers, and absorbers.

The Ministry of the Environment has the authority to stop operations causing discharges into the environment that create immediate and serious dangers to public health. It can also initiate legal action for violation of either a regualtion made under the Act, or of a Minister's order issued to correct a pollution condition. Maximum fine for an individual is $2,000; for a corporation on the first conviction, $5,000; and $10,000 for any further convictions. Each day that a violation occurs is a separate offence.

Numerous regulations have been made under The Environmental Protection Act. These include standards for emitted contaminants, air pollution emission standards for motor vehicles, ferrous foundries and asphalt paving plants.

Air pollution index

In addition, Environment Ontario has established an air pollution index, or API, to give warning of, and to prevent, air pollution buildups or episodes. It is based on continous measurements of sulphur dioxide and suspended particulate matter in the air — these contaminants have been found in high concentrations during severe air pollution episodes. Large communities such as Toronto, Welland, Hamilton, Windsor, Sudbury, and Niagara Falls, are monitored intensively under the API.

The index is a numerical scale beginning at zero. Readings below 32 are considered acceptable, and the sulphur dioxide and particulate matter present in the atmosphere should have little or no effect on human health. At 32, if meteorological conditions are expected to remain the same for six hours, owners of major sources of air pollution are warned that they may have to reduce production. At 50 and 75, under continuing bad conditions, they may be ordered to curtail operations, and at 100, the Ontario Ministry of the Environment can order all operations, not essential to public health or safety, to shut down. A reading of 100 is not likely to be reached because of the provisions for curtailment made at lower index levels. The highest the index has reached to date in Ontario was 76 in Welland, in October of 1974.

The index is designed to protect public health. People with chronic respiratory diseases may be affected at a level of 58, while people in good health may experience only mild affects, even if the index reaches 100.

Landscape not picturesque when litter takes over

Picture softly rolling hills fading off into the mist, a gentle brook rolling by, and full, green shrubs dotting the countryside. But scattered among this beautiful sight are not the flowers you'd expect to find.

Just over that hill is an ugly, gaping hole where an open pit mine used to be. And behind the shrub, stands an old, abandoned car. Glittering in the brook are pieces of broken glass. And strewn across the meadow are wrappers, pop cans and garbage.

Not such a beautiful sight anymore, is it? And to think that all this was caused by people who just didn't care!

Land pollution has been with us since our primitive ancestors threw the first dinner bones to the dogs. Archaeologists make their living by digging up items thrown away, mislaid, broken or buried centuries ago.

Today, land pollution is primarily caused by 1) derelict autos, 2) improper use of dump sites or lack of disposal facilities, and 3) derelict buildings and the remains of industrial operations.

Here are some land pollution points to ponder:

— Ontario residents produce eight million tons of garbage annually, and pay about $100 million in taxes for collection and disposal.

— over 450,000 cars are junked annually across Canada.

— each year Canadians throw away about three billion bottles and jars, five billion cans, and five million tons of paper.

— the amount of garbage produced in Toronto each year would fill the C.N.E. Stadium to the height of the CN Tower.

— solid waste, either collected by municipalities or carelessly thrown away, by volume, is made up of:

36.4% — paper
25.0% — organic matter
14.9% — wood
8.2% — metal
7.2% — glass
3.6% — rock and rubble
2.5% — textiles
1.7% — plastics
.5% — tires

All it takes to clean up land pollution is a little caring. There are several ways you can help.

1. Use the garbage cans. If there aren't any around in the immediate vicinity, save the trash until you see one.

2. Buy milk and soft drinks in returnable bottles. Take them and beer bottles back to the store for a refund.

3. Sell old cars and appliances to the scrap dealer, or get them recycled.

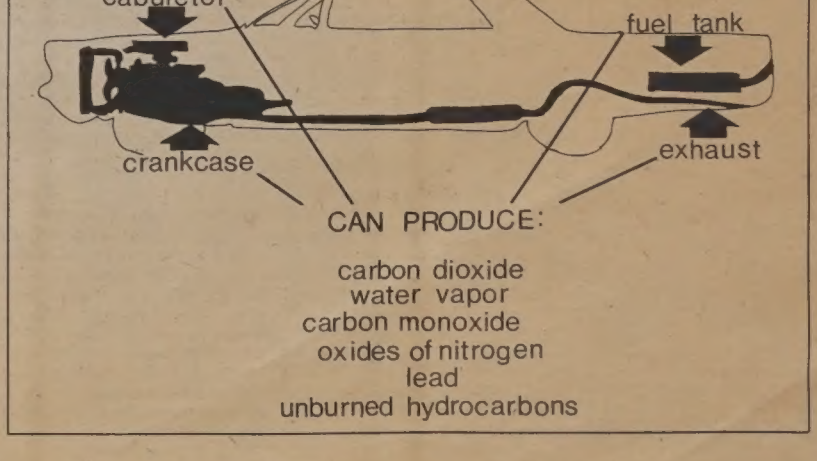
4. Throwing glass bottles against rocks to see it explode or to test your throwing skill is kid's stuff. Put them in the garbage.

5. When camping, make sure all degradable garbage is buried, and all other garbage is carried back to a trash can.

6. Encourage everyone in your family to become "waste conscious" — to pick up litter when they see it, and deposit it in the trash can.

7. Dumping the contents of a car's ashtray in a parking lot is something only a slob would do.

8. Have a "TRASH BASH" with your friends — it's a fun way to clean up the neighbourhood!



Smog in space . . . believe it or not

Air

— in the middle ages, certain churchmen feared that coal would make earthly fires look like the fires of hell.

— a law was passed in 1306 in England forbidding the burning of coal while Parliament was in session. One man, who sold and burned soft coal, defied this law. He was tortured and hanged.

— on the historic Apollo 8 moon - orbiting mission in December 1968, the astronauts spotted Los Angeles with no trouble, hundreds of miles in space, by finding the four hundred square mile blanket of smog.

— over 2,250 tons of hydrocarbons are released daily into the air of Ontario from automobile exhausts.

— during a typical day in New York City, a resident breathes in the equivalent of smoking 38 cigarettes. The estimate for Torontonians is approximately 20 cigarettes.

— the average person breathes about 22,000 times each day, taking in 3,500 gallons of air.

— every time you inhale in a clean suburb or small town, you're breathing in about 40,000 particles of dust — in a city, this figure increases to over 70,000!

— six million tons of gases and particulates flow into Ontario's air every year.

Water

— the river at Coccolia, Italy, had such a terrible smell that the citizens put up signs naming the town Puzzolia, which means "Stinkville".

— nuclear reactors use 50 per cent more water for cooling purposes than other types of power plants, and they may be used more extensively in the future.

— it takes 70 thousand to 110 thousand gallons of water to produce one ton of steel.

— poor people in tropical countries use less than five gallons of water each per day, while in Beverly Hills, California, the average person uses five hundred gallons of water each day.

— Ontario residents produce 300 billion gallons of sewage each year.

— about 70 per cent of your body is made of water, and you can only live a few days without water to drink.

—the amount of water on the earth never changes — you may be drinking a water molecule that Julius Caesar drank 2500 years ago.

—Lake Erie has aged 15,000 biological years in the past 50 years.

Pesticides

— the earth receives about 70 per cent of its life - sustaining oxygen from the photosynthetic processes of marine plant life.

—DDT in marine life lowers the rate of photosynthesis.

— there are about 1,000,000 species of insects, of which only 900 species are harmful to man.

— the World Health Organization has estimated that the effective use of DDT has saved five million lives and prevented 100 million illnesses.

— the average concentration of DDT in humans ranges from two parts per million (ppm) in England, to 10 - 20 ppm in Canada. In India, where DDT is used extensively, the average is 31 ppm.

— it has been estimated that one third of Canadian crops, valued at $1500 million, are lost annually to nuisance plants, insects, and diseases.

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That Sunday boat cruise can cause more damage to your lake than you imagine.

Tips for smoother sailing from Environment Ontario

It's a long, hot weekend. You're finally at the cottage. The lake looks so inviting, and you can hardly wait to take the boat out for a long cruise.

Stop! Do you know what really happens when you start up that engine? Have you thought about the damage that is being done to the lake and its life from the exhaust gases, oil discharges, gas spillage, turbulance, and noise?

All internal combustion engines produce exhaust gases and as much as 20 per cent of the fuel is lost in an engine's smokey exhaust. This emission contains four main components: organic hydrocarbons, carbon monoxide, lead, and nitric oxide. Although they are all toxic, lead is the worst because it does not break down, and it tends to accumulate in aquatic life.

Fuel spilled into the water has different effects than exhaust gases. Over a period of time, the gasoline usually evaporates, leaving a thin film of oil or an emulsion of tiny suspended particles on the surface. This film has adverse effects on plankton, the primary food of most aquatic life. Oil does not kill the plankton, but it affects its reproduction thus upsetting the lake's ecosystem. A thin surface film of oil also prevents the necessary transfer of oxygen from the air to the water.

Heavy boating can be destructive to the shoreline by creating wave action which erodes the banks and leaves a thin layer of silt or fine soil on the lake floor. This settled layer can stunt or eliminate the aquatic life.

Turbulance in the lake also disrupts aquatic life by causing the plants to uproot. The uprooted plants die, and fall to the lake bottom to rot. The rotting plants act as a fertilizer for future weed growth and reduce the level of oxygen required by fish. Sometimes large fish kills result. Running a motorboat through a weed patch has the same effect.

The constant roar of boat engines can also damage the human ear. The level where damage occurs over a period of time is 85 dB. The sound level of a boat engine from 50 feet away varies between 64 - 77 dB. If you are travelling in a boat over a long period of time, permanent ear damage may occur because of the high noise level. Along with partial and total deafness, high noise levels also affect heart disease, ulcers, and cause hypertension.

What can you do to help your lake, while still enjoying your boat? Just follow these seven easy steps, and have a cruise for a better lake environment.

Suggestions for Better Boating

1. Always keep the engine tuned. This includes cleaning and adjusting the plugs, ignition points, fuel system, and carburetors. An untuned engine wastes fuel through incomplete combustion.

2. Use the correct oil and gas mixture. Use lead - free or low - lead gas if your motor will run on it.

3. Avoid spillage. Fill your tank away from the water. Check to see that the marine operator doesn't overfill your oil and gas tanks. Don't "top the tank".

4. Don't run the motor if it isn't necessary. If you are waiting on the dock for someone, turn it off. Oil films are most distasteful in swimming areas.

5. Be courteous when driving. Stay away from shore and remember that canoeists, sail boaters, fishermen, swimmers, and wildlife would also like to use the lake.

6. Reduce your speed near shore or in narrow channels.

7. When buying a motor boat insist on a quiet engine. Better still, buy a canoe or a sailboat — they don't pollute.

B.C. by permission of John Hart and Field Enterprises, Inc.

Ogg cartoons

The Ogg cartoons shown in this issue are available in poster size from the Ontario Ministry of the Ministry, Information Services Branch, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5. Due to the limited quantity, only one set is available per classroom.

Ontario's Environment Today was published by the Ministry of the Environment, Information Services Branch, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5. Additional copies are available free-of-charge.

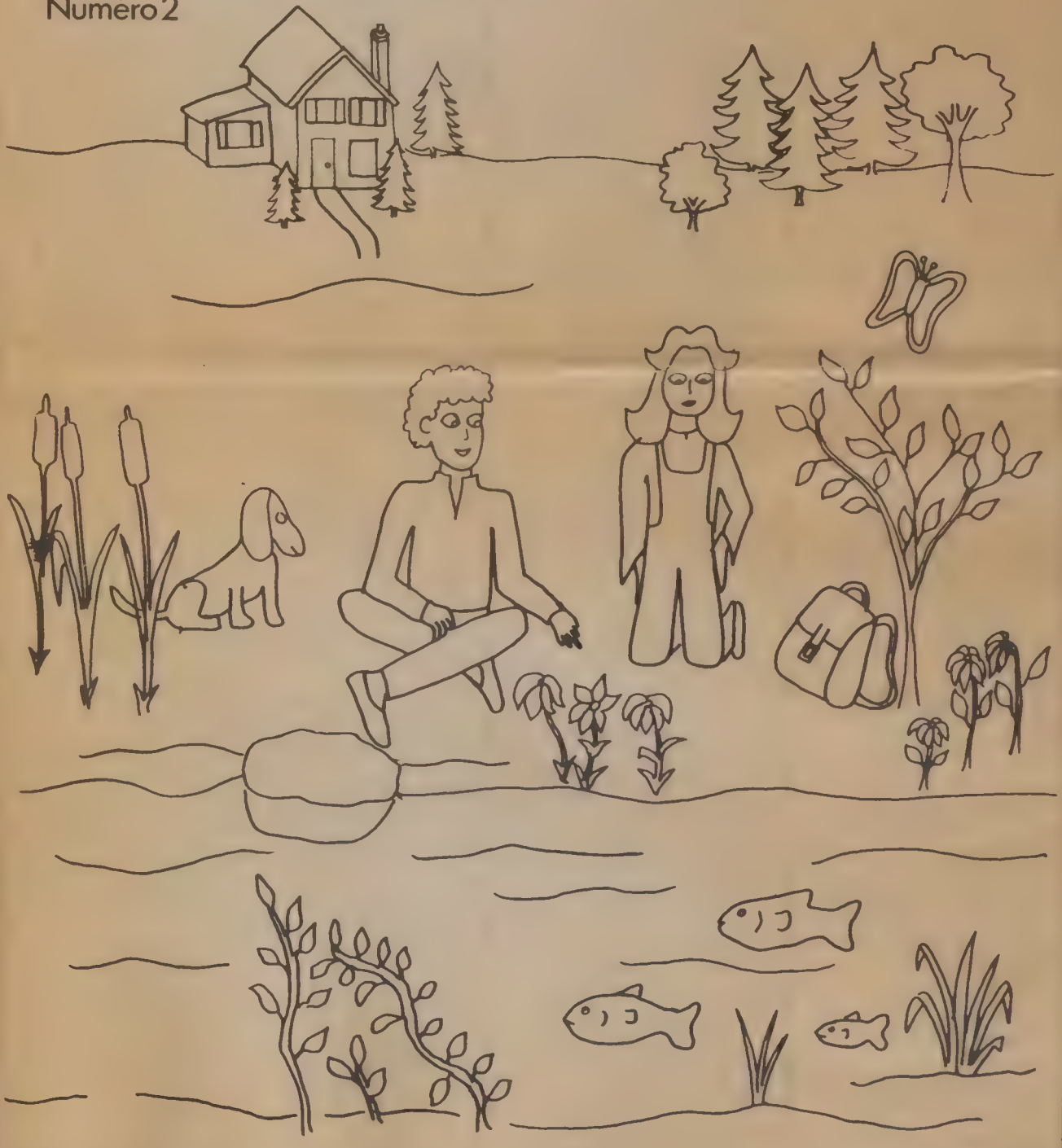
Editor ..... Jane Watson

Writer/Illustrator ..... Judy M. Scott

ÉTUDE ET JEUX

SUR L'ENVIRONNEMENT

Numéro 2



Les arcs-en-ciel de Monsieur Ronchonneau

par Jane Watson

Il y avait longtemps que la région de Pâqueretteville n'avait pas vu d'arc-en-ciel. Le bon Monsieur Ronchonneau, qui s'occupait avec soin de l'environnement, avait coutume d'accrocher des arcs-en-ciel au firmament lorsque la région de Pâqueretteville était particulièrement propre. Il voulait ainsi montrer aux habitants combien il était fier d'eux.

Mais Monsieur Ronchonneau n'était pas encore revenu de ses vacances dans le Sud.

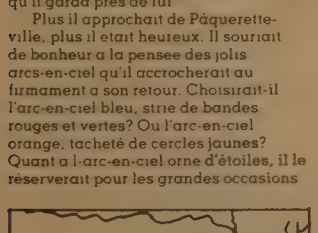
Chaque année, à l'approche de l'hiver, il partait vers le Sud pour réchauffer ses vieux os au soleil et refaire ses forces en vue du travail qui l'attendait au printemps, à son retour. Car ce n'est pas une mince tâche que de garder l'environnement toujours propre.

Mais cette année-là, les avions des sociétés aériennes restèrent cloués au sol en raison d'une grève des pilotes. Monsieur Ronchonneau fut donc obligé de prolonger ses vacances dans le Sud. La chose ne lui déplaisait pas, car il pouvait ainsi se dorer au soleil et se reposer davantage. Il eut même la bonne fortune de trouver, à un prix dérisoire, dans un petit magasin, de nouveaux arcs-en-ciel.

C'étaient des arcs-en-ciel merveilleux, de toutes les couleurs — comme le sont tous les arcs-en-ciel. Il y en avait même un qui était orné d'étoiles!

Mais les avions ne décollaient toujours pas. Monsieur Ronchonneau décida donc de revenir en autocar. Il prit soin de ranger précieusement ses nouveaux arcs-en-ciel dans une caisse, qu'il garda près de lui.

Plus il approchait de Pâqueretteville, plus il était heureux. Il souriait de bonheur à la pensée des jolis arcs-en-ciel qu'il accrocherait au firmament à son retour. Choisirait-il l'arc-en-ciel bleu, strié de bandes rouges et vertes? Ou l'arc-en-ciel orange, tacheté de cercles jaunes? Quant à l'arc-en-ciel orné d'étoiles, il le réserverait pour les grandes occasions



Mais plus il se rapprochait de Pâqueretteville, plus il devenait taciturne. Soudain, des larmes inondèrent son visage. Jamais il ne pourrait accrocher d'arc-en-ciel à Pâqueretteville la région était dans un tel désordre! Monsieur Ronchonneau était fort mécontent

Il y avait dans l'air tellement de fumée que le soleil n'arrivait pas à la percer. La rivière était sale et pleine de rebuts. Toutes les maisons étaient grises. Même les fleurs faisaient grise mine, et les habitants semblaient tristes et fatigués. La pollution faisait ses ravages dans la région.

Monsieur Ronchonneau descendit de l'autocar et gagna tristement sa maison, traînant sa boîte d'arc-en-ciel.

—J'aurais dû revenir plus tôt! soupira-t-il. Ah! Si j'avais été ici au printemps, cela ne serait pas arrivé.

La pollution atmosphérique saisit Monsieur Ronchonneau à la gorge.

En arrivant chez lui, il aperçut Jean, Julienne et Angèle assis sur son perron. L'année précédente, les trois enfants l'avaient aidé à nettoyer la région, mais cette fois-ci, ils étaient très tristes.

—Monsieur Ronchonneau, commença Julienne, nous pensions bien que vous ne reviendriez plus jamais. Notre magnifique région de Pâqueretteville s'est transformée en un endroit horrible. Peut-être même ferions-nous mieux de déménager.

Julienne était une petite fille qui aimait les choses belles et propres.

Jean, très sage malgré son jeune âge, reprit:

—Non, ce n'est pas là une solution. La pollution pourrait nous suivre partout. Nous ne pouvons pas toujours déménager.

Pour sa part, Angèle ne faisait que pleurer. Les grosses larmes qui coulaient de ses yeux tombaient sur les fleurs souillées, à ses pieds.

—Tout ça est de ma faute! dit Monsieur Ronchonneau. J'aurais dû revenir plus tôt. J'avais pourtant bien recommandé à mes amis Vent rieur, Eau capricieuse et Pluie fertile de bien faire leur travail en mon absence. J'étais sûr qu'avec la collaboration de tous, la région resterait propre et belle.

—Pourtant, répondit Jean, nos trois amis Vent rieur, Eau capricieuse et Pluie fertile ne se sont pas montrés depuis l'automne dernier.

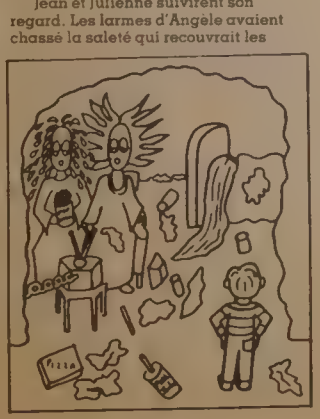
—Lorsque le printemps est arrivé, en constatant que l'air et l'eau étaient sales, plus personne ne s'est soucié de l'environnement, reprit Julienne.

La petite Angèle, silencieuse, versait des torrents de larmes.

—Est-il trop tard, Monsieur Ronchonneau, demanda Jean, pour faire de notre région un endroit aussi propre qu'avant?

—Je crains fort que oui, soupira Monsieur Ronchonneau. Puis, soudainement, il regarda fixement aux pieds d'Angèle et son visage s'illumina.

Jean et Julienne suivirent son regard. Les larmes d'Angèle avaient chassé la saleté qui recouvrait les



fleurs, et ces dernières avaient repris leurs jolies couleurs jaune et rose.

—Tu viens de me donner une idée, petite Angèle, s'écria Monsieur Ronchonneau tout joyeux. Il n'est pas trop tard pour arrêter la pollution qui ternit notre région de Pâqueretteville. Mais il nous faudra faire vite... et nous aurons besoin d'aide. Attendez un peu, ajouta-t-il en se grattant le menton.

Jean et Julienne se regardèrent. La petite Angèle cessa de pleurer.

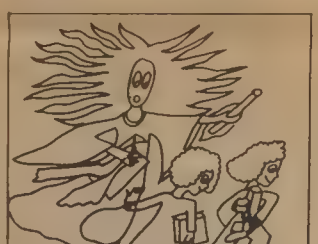
—Voilà! dit Monsieur Ronchonneau en tapant des mains. Tout d'abord, je vais de ce pas rendre visite à Vent rieur, Eau capricieuse et Pluie fertile, pour qu'ils se remettent au travail.

Monsieur Ronchonneau laissa sa boîte d'arcs-en-ciel sur le perron. Accompagné des enfants, il alla trouver ses trois amis qui vivaient ensemble au sommet de la montagne.

En arrivant au sommet, les trois enfants furent tout étonnés. Le sol autour de la cabane était couvert de vieux papiers, de contenants vides et de boîtes de carton. A l'intérieur, le spectacle était tout aussi désolant: il y avait des boîtes de conserve vides, des pailles et des serviettes qui traînaient partout. Tout était couvert de poussière et sentait mauvais.

Vent rieur et Pluie fertile regardaient la télévision en mangeant des grains de maïs soufflé. Le volume était si fort qu'ils n'entendirent pas Monsieur Ronchonneau et ses amis arriver. Quant à Eau capricieuse, elle dormait encore, la tête enfouie sous les couvertures.

Monsieur Ronchonneau était furieux. Il ferma immédiatement le téléviseur. Lorsque Vent rieur et Pluie fertile l'aperçurent, ils furent très inquiets et se mirent à parler tous deux à la fois.



—Oh, Monsieur Ronchonneau! Quelle surprise! Quand êtes-vous arrivé? Avez-vous fait bon voyage? On ne vous attendait pas si tôt! dit Vent rieur. Il essayait de sourire, mais Monsieur Ronchonneau fronçait toujours les sourcils.

Pluie fertile lui dit:

—J'allais justement sortir pour aller travailler à la rivière. J'ai travaillé très fort, vous savez, et j'ai même attrapé une vilaine grippe la semaine dernière.

Monsieur Ronchonneau ne disait rien. Il se dirigea vers le lit d'Eau capricieuse et tira les couvertures. Notre amie ouvrit un oeil, puis l'autre. Apercevant Monsieur Ronchonneau, elle se mit à trembler et voulut se cacher la tête sous l'oreiller.

—Debout, dit fermement Monsieur Ronchonneau. Je veux vous parler, à toi et à tes deux compères... Qu'avez-vous à dire? Vous aviez pourtant convenu d'aider à protéger l'environnement pendant mon absence. Mais à mon retour, je trouve la région sale et toute polluée. Les habitants parlent même de partir, dit Monsieur Ronchonneau tristement.

Pluie fertile prit la parole:

—Dès la fonte des neiges, au printemps, nous sommes sortis pour travailler. Mais nous étions un peu fatigués, et il y avait tant à faire. En outre, aucun des habitants de Pâqueretteville ne semblait intéressé à protéger l'environnement.

—Pourtant, nous étions prêts à vous aider, reprit Julienne, qui était restée près de la porte avec Jean et Angèle.

Eau capricieuse se mit à rire:

—Qu'est-ce que vous racontez là? Nous vous avons bien vus, au printemps. Jean s'amusait avec des boîtes de conserve vides dans la rue. Angèle avait jeté l'emballage de sa tablette de chocolat près d'une poubelle, plutôt que de le mettre dans la poubelle. Quant à toi, Julienne, nous t'avons vue passer près d'un bâtonnet de popsicle sans le ramasser.

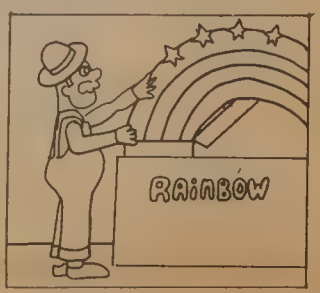
—Ce n'est pas moi qui l'avais jeté là, dit Julienne. Ce n'était pas à moi de le ramasser.

—C'est de là que viennent tous nos ennuis, reprit Monsieur Ronchonneau. Si toute le monde attend que les autres nettoient l'environnement, personne ne commencera.

—Nous allions justement sortir pour commencer notre travail quand vous êtes arrivé, reprit Vent rieur. Ainsi, vous n'auriez rien su de tout cela, et vous auriez pu accrocher à l'horizon un joli arc-en-ciel.

—Mais ce n'est pas pour moi qu'il faut protéger l'environnement, répondit Monsieur Ronchonneau. C'est dans votre propre intérêt. N'êtes-vous pas intéressés à voir le soleil, à respirer de l'air pur, à vous asseoir près d'un ruisseau aux eaux limpides et à marcher dans des rues propres? N'éprouvez-vous pas plus de fierté pour votre environnement?

—Oh oui! répondirent en choeur nos trois amis et les trois enfants. Mettons-nous au travail!



—Il n'est pas trop tard, n'est-ce pas? demanda Jean.

—Non, il n'est pas trop tard, répondit Monsieur Ronchonneau. Angèle nous l'a prouvé tout à l'heure en nettoyant les fleurs de ses larmes. Il nous faudra travailler plus fort maintenant que si nous avions commencé plus tôt. Mais il ne sert à rien de récriminer. Mettons-nous immédiatement à l'oeuvre!

—Si l'on prenait d'abord quèlques minutes pour nettoyer cet endroit? dit Vent rieur. Je ne suis pas très fier de ce que nous avons fait. Je vais souffler et rassembler tous les déchets; ensuite, peut-être que les enfants pourraient les apporter au remblai sanitaire pour les y déposer.

—Mais bien sûr! répondit Julienne.

Vent rieur se mit à souffler pour nettoyer la cabane et les alentours. En un rien de temps, tout fut nettoyé. Pour ne pas être en reste, Eau capricieuse et Pluie fertile lavèrent la cabane, qui brilla bientôt de tout son éclat. L'endroit commença bientôt à sentir bon.

Ensuite, Vent rieur, Eau capricieuse et Pluie fertile, avec l'aide de Monsieur Ronchonneau et des trois enfants, se mirent à nettoyer la région.

Pluie fertile lava les nuages, les fleurs et les pelouses. On aperçut bientôt le soleil, qui brillait de tous ses feux, et les fleurs se mirent à balancer la tête, heureuses.

Eau capricieuse commença à laver la rivière et déposa les rebuts sur la berge. Monsieur Ronchonneau et Jean les ramassèrent et les apportèrent au remblai sanitaire. L'eau fut bientôt propre.

Vent rieur souffla de toutes ses forces sur la région et rassembla les déchets en un seul endroit. Julienne et Angèle les firent vite disparaître.

Lorsque les habitants de Pâqueretteville se rendirent compte de ce grand nettoyage de la région, ils commencèrent à apporter leur aide.

Malgré la collaboration de chacun, il fallut encore beaucoup de temps pour nettoyer la région, qui était dans un état de désolation.

Tout finit bientôt par rentrer dans l'ordre, et la région fut de nouveau propre et belle.

—Ouf! C'est enfin fini! dit Eau capricieuse. Je peux maintenant retourner me coucher. Si vous voulez un coup de main l'an prochain, ne vous gênez pas!

Suite page 4

Il y a 12 000 ans, Mme Ogg ne savait pas quoi faire de ses ordures.

Ontario
Ministère de l'Environnement

Pour tout renseignement sur la gestion de l'air, écrivez à

Direction des services d'information
Ministère de l'Environnement
135 ouest, avenue St-Clair
Toronto, Ontario
M4V 1P5

Nous n'avons toujours pas résolu le problème.

AFFICHE À COLORIER

De l'âge des cavernes à l'usine de recyclage!

par Donna Brockwell

Ce jour-là, malgré le soleil qui brillait, Jean était assis sur le perron, l'air triste, se demandant ce qu'il pourrait bien faire sans ses amis: André était parti à la campagne avec sa famille pour une semaine, Paul était allé chez le dentiste et David était à la colonie de vacances. Tout absorbé dans ses pensées, il ne fit pas attention au petit garçon qui se dirigeait vers lui. Il ne le vit que lorsque ce dernier ne fut qu'à quelques mètres. Il fut surpris par les vêtements qu'il portait. L'enfant était pieds nus et n'avait pas de chemise, chose normale par cette journée chaude. Mais il portait un short fait de fourrure!

- Bonjour! fit le garçon. Comme tu étais seul, j'ai pensé venir te saluer. Je [illegible] visite chez ma tante cette semaine, mais je n'y m'amuse guère.

- Je suis content de te voir, répondit Jean. Je me demandais justement ce que je ferais aujourd'hui. Mes amis sont tous partis. Je m'appelle Jean.

- Et moi, je m'appelle Cric Crac.

- Qu'aimerais-tu que nous fassions? Une promenade en vélo? Je peux te prêter le mien et prendre celui de mon frère.
- Cela me plairait bien, mais je n'ai jamais fait de vélo.

- Tu n'as jamais fait de vélo? reprit Jean étonné.

- Non, répondit Cric. J'ai vécu ici il y a 12 000 ans, et c'est pourquoi je porte un short fait de fourrure, car c'est ainsi que nous nous habillions autrefois. Mais nous n'avions pas alors de bicyclette.

- Viens, je vais te montrer. C'est facile.

Les deux enfants enfourchèrent leur vélo et roulèrent en direction de la campagne.

Cric s'arrêta soudain, sidéré, devant un monceau de déchets le long de la route.

- Qu'est-ce qu'il y a? demanda Jean.

- Je n'arrive pas à croire que vous jetez encore vos ordures dans la nature! C'est ce que nous faisions il y a 12 000 ans: quand il y en avait trop, ou que leur odeur était insupportable, nous nous installions ailleurs. Or aujourd'hui, même si vous avez construit des usines, des voitures, des bicyclettes et des vaisseaux interplanétaires, vous jetez encore vos ordures dans la nature.

- La plupart n'agissent pas ainsi, répondit Jean. Ces ordures doivent provenir d'une personne trop paresseuse pour les apporter à [illegible].

- Oh! demanda Cric.

- Au cimetière sanitaire. Il y en a un tout près d'ici. Allons le visiter.

Les garçons arrivèrent bientôt à la barrière d'entrée du cimetière sanitaire et déposèrent [illegible] les ordures.

Dans la cour, [illegible] Jean les camions viennent [illegible] pour les apporter [illegible].

- Bonjour, les enfants! Puis-je faire quelque chose pour vous [illegible] se tenait derrière eux. Les enfants se retournèrent.

- On se demandait ce que deviennent les ordures après que les camions les ont ramassées, répondit Jean.

- Venez avec moi, je vais vous montrer.

L'homme les fit monter dans son camion.

- Il n'y a pas si longtemps, on se contentait de déposer les ordures au dépotoir, expliqua l'homme qui s'appelait Robert. Mais c'était là une façon peu efficace de s'en débarrasser, les ordures répandaient une odeur nauséabonde. Sans compter que le vent dispersait partout les papiers, et que les rats pullulaient dans les dépotoirs, qui étaient source de nombreuses maladies.

- Mais pourquoi ne brûle-t-on pas ces déchets? demanda Jean.

Robert sourit.

- Ta mère a sans doute déjà brûlé des aliments en faisant la cuisine? Souviens-toi de l'odeur qui s'en dégageait! Imagine l'odeur désagréable qui se répandrait si l'on brûlait tous les rebuts. L'air serait très pollué.
- Ah! je n'y avais pas pensé! Et il faudrait aussi se débarrasser des cendres.

- Aujourd'hui, dès que les ordures atteignent une hauteur de 60 cm, ou à la fin de chaque jour, on les recouvre d'une couche de terre.

- Mais c'est une excellente idée! s'écria Cric. Ainsi, il n'y a pas d'odeur désagréable.

- Parfaitement! En outre, quand nous avons fini, nous recouvrons le terrain de gazon. Et voilà un parc de plus, ou un espace pour le ski.

- Ce terrain va-t-il servir pour le ski? Ce serait merveilleux! s'écria Jean.

En silence, les enfants regardèrent les camions décharger les rebuts, pendant qu'un bouteur les étalait uniformément.

- Je n'aurais jamais cru qu'il pouvait y avoir autant de déchets!

- Savez-vous, reprit Robert, que chaque Canadien produit 1,8 kilogramme de déchets par jour? Il faut donc beaucoup de terrains pour éliminer ces déchets. En outre, nos ressources naturelles sont à jamais perdues lorsque nous les enfouissons.

- Les ressources naturelles? demanda Cric.

- Oui. Par exemple, chaque fois qu'on jette du papier d'aluminium, on se trouve à gaspiller cette ressource qu'est l'aluminium. Or, c'est là une ressource naturelle qui s'épuise et ne se renouvelle pas.
- C'est comme le pétrole, poursuivit Jean. C'est aussi une ressource naturelle. Mon père dit que nous allons bientôt en manquer.

- Nous ne devons donc pas gaspiller nos ressources naturelles, mais les réutiliser, reprit Cric.

- Tiens! N'est-ce pas pour cela qu'on récupère les vieux journaux chaque semaine?

- Parfaitement, répondit Robert. Et c'est la même chose pour les bouteilles consignées. Le ministère de l'Environnement cherche actuellement de nouvelles façons d'utiliser tous les rebuts que nous produisons. Que diriez-vous d'une visite à un centre expérimental de recyclage? Je m'y rends à l'instant.

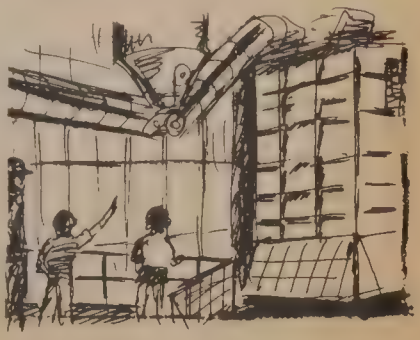
- Nous en serions ravis! répondit Cric.

Robert les amena au centre de recyclage des ressources, à Downsview (Toronto).

Les ordures ménagères transportées par camion sont déchargées ici, expliqua Robert dans le bruit assourdissant des camions. La plupart des rebuts sont acheminés sur ce convoyeur, où l'on retire tous les gros objets de papier, tels que les boîtes, et les articles qui peuvent être dangereux.

Tiens! Regarde! Un vieux poêle!

- Ce vieux poêle sera déchiqueté par une déchiqueteuse de 1 000 HP en morceaux de 15 cm. Cette machine peut déchiqueter des réfrigérateurs, des pneus ou toutes sortes de gros objets.



Une fois déchiquetés, les rebuts sont acheminés dans un séparateur d'air — c'est le tunnel que vous voyez là. L'air y circule à la moitié de la vitesse d'un ouragan! Il expulse le plastique déchiqueté, qui sert à chauffer l'usine, et le papier, qui est récupéré pour en extraire la fibre.

Les déchets plus gros qui restent sur le convoyeur sont surtout des rebuts de métal ou de verre et des déchets alimentaires.

À l'aide de gros aimants, on recueille certains métaux, et on trie à la main d'autres métaux tels que le laiton et l'aluminium. Ces métaux sont ensuite récupérés par les industries pour fabriquer de nouveaux produits.

- Que deviennent les rebuts après leur passage dans ce cylindre?

- Les éclats de verre et le verre concassé passent par les trous du cylindre et sont recueillis dans des bacs, puis stockés avant d'être vendus à l'industrie du verre.

- Et les déchets alimentaires, demanda Jean. Qu'en fait-on?

- Une partie des déchets alimentaires et des feuilles mortes sert à produire l'énergie nécessaire à l'usine, ou est mélangée avec des boues d'égout et transformée en compost.

- Nous avons un silo à compost à la maison, dit Jean. Tous les deux mois, papa en retire le compost et l'utilise comme engrais pour le jardin.

- Alors, vous voyez, mes enfants, presque tout ce que nous utilisons peut être récupéré, sauf quelques rares exceptions. Nous avons réussi à réduire considérablement la quantité des rebuts qui sont enfouis dans les remblais sanitaires.

- Je suis forcé de constater que les méthodes d'élimination des déchets ont changé considérablement depuis 12 000 ans, dit Cric.

- Tu as raison. Mais ces méthodes ne sont efficaces que si chacun apporte sa collaboration.

Activités suggérées

Des rebuts... moins rebutants

Un jardin... qui sort de sa coquille!

Je recueille les vieux journaux

Je fabrique moi-même mon papier

Les arcs-en-ciel de Monsieur Ronchonneau

— Au fait, dit Monsieur Ronchonneau, n'avez-vous pas tiré une leçon de ces événements? Il nous faut tous travailler chaque jour pour protéger notre environnement, autrement la tâche deviendra vite impossible.

- Oui, répondit Vent rieur, et je n'oublierai pas cette leçon. Je veillerai aussi à ce que Eau capricieuse et Pluie fertile ne l'oublient pas non plus.

— Je n'ai pas besoin qu'on me le rappelle, dit Pluie fertile. J'ai travaillé si fort ces jours derniers que jamais plus je ne veux avoir un tel retard à rattraper! Dorénavant, chaque jour, je ne manquerai pas de faire ma part pour garder l'environnement propre.

— Nous aussi, reprirent en chœur les trois enfants.

— Monsieur Ronchonneau, demanda soudain Jean, n'avez-vous pas oublié quelque chose?

— Non, je ne crois pas, reprit Monsieur Ronchonneau. Les déchets sont disparus, l'eau est propre, l'air est pur. Tout est maintenant parfait à Paqueretteville... Ah! mais attendez un peu! Je sais ce que tu veux dire. Je reviens dans quelques minutes...

Monsieur Ronchonneau courut chez lui chercher sa boîte d'arcs-en-ciel. Il était tellement fier qu'il sortit de la boîte son plus bel arc-en-ciel: l'arc-en-ciel orné d'étoiles!

Puis, utilisant les pouvoirs magiques qu'il avait reçus de son père il y a très longtemps, il accrocha à l'horizon son bel arc-en-ciel étoilé.

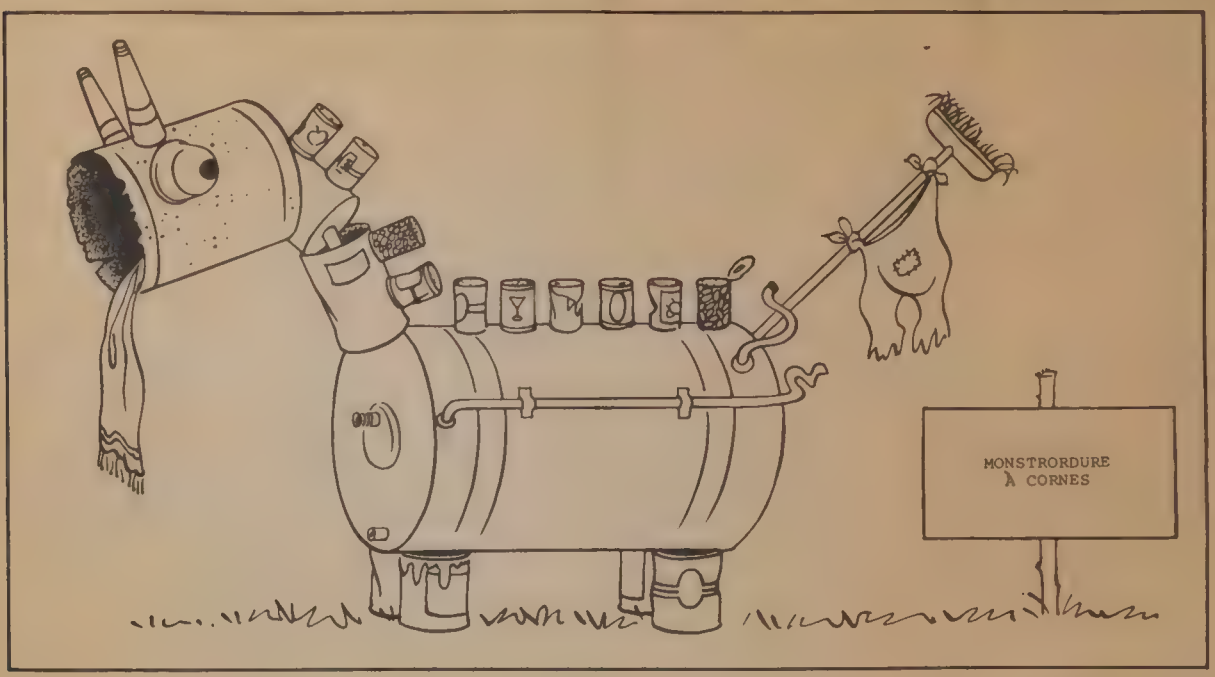
Le spectacle était si beau que tous les habitants sortirent de leur maison pour admirer le firmament. Chacun se promit de toujours faire sa part pour ne pas polluer l'environnement, afin que la région reste toujours belle et garde son arc-en-ciel étoilé.

Puis Jean, Julienne et Angèle se mirent à danser et à pousser des cris de joie. Vent rieur, Eau capricieuse et Pluie fertile entrèrent aussi dans la ronde.

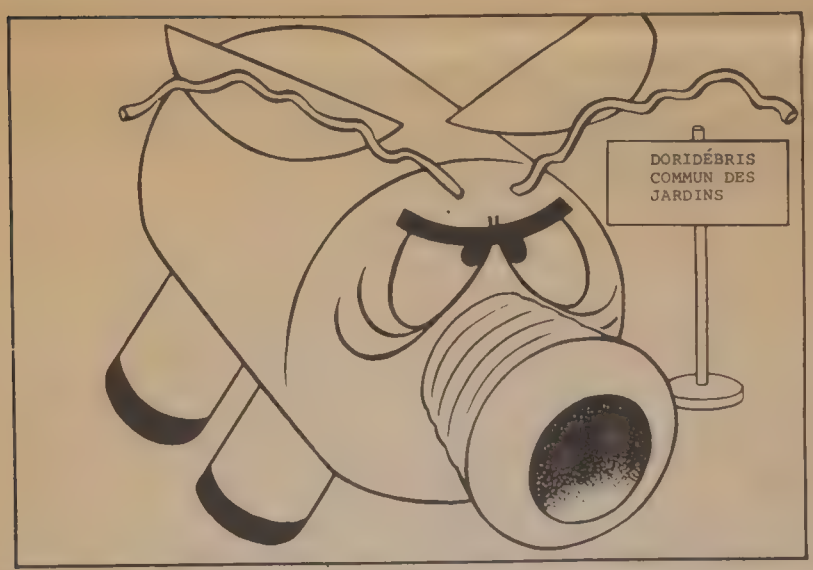
Monsieur Ronchonneau souriait. Il n'avait jamais été aussi fier.

FIN

DES REBUTS...MOINS REBUTANTS!

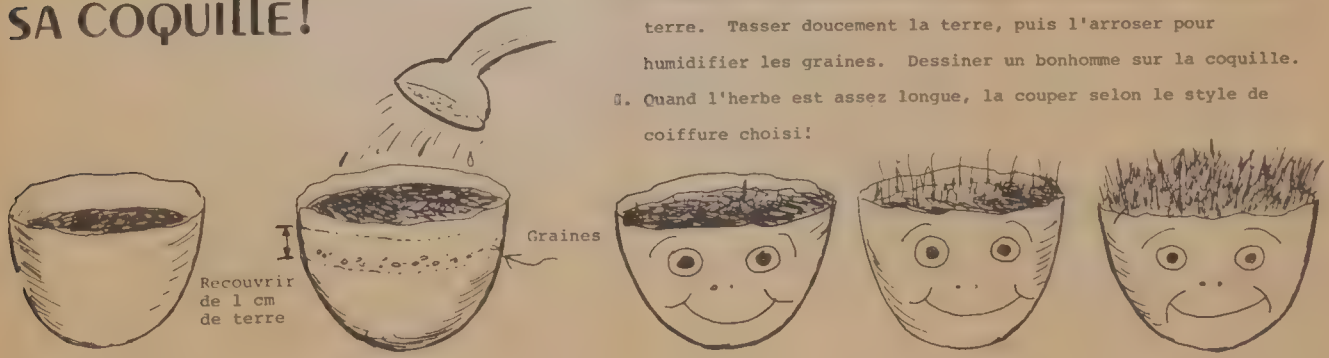


Vous pouvez transformer des rebuts en oeuvres d'art semblables à celles-ci... puis donner un nom à votre chef-d'oeuvre!

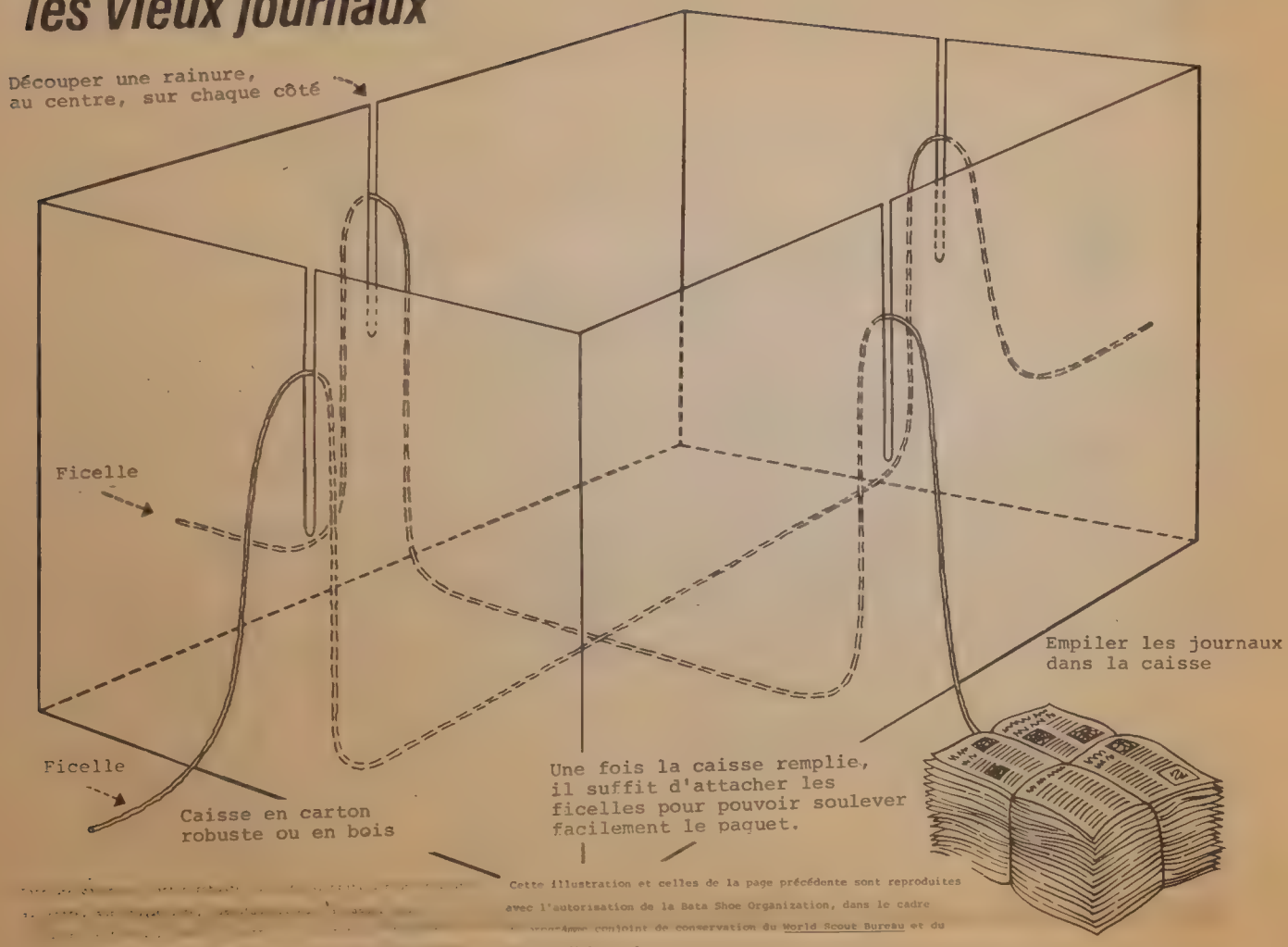


UN JARDIN...QUI SORT DE SA COQUILLE!

1. Remplir de terre, aux deux tiers, une coquille d'oeuf ou un contenant sphérique analoque.
2. Y semer des graines de gazon, puis les recouvrir de 1 cm de terre. Tasser doucement la terre, puis l'arroser pour humidifier les graines. Dessiner un bonhomme sur la coquille.
3. Quand l'herbe est assez longue, la couper selon le style de coiffure choisi!



Je recueille les vieux journaux



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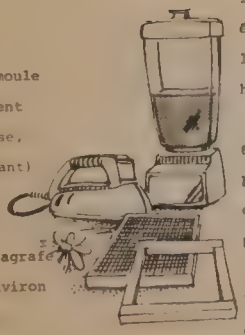
[illegible] fixer [illegible] emballage.

JE FABRIQUE MOI-MÊME MON PAPIER

Matériel

Papier de rebut
Restes de plantes et de légumes
Agrafes, punaises ou colle hydrofuge
2 cadres en bois (20 cm x 15 cm)
Moustiquaire en nylon
Torchons à vaisselle (2)
Cuvette
Mélangeur
Éponge
Fer à repasser

1. Pour fabriquer du papier, il faut d'abord construire un moule ou une forme à l'aide d'un cadre en bois et y fixer solidement une moustiquaire en nylon. Si l'on veut un papier plus lisse, on peut aussi utiliser un deuxième cadre en bois (cadre volant) sans moustiquaire.



2. Prendre du papier de rebut, enlever le plastique ou les agrafes qui s'y trouvent, et le déchiqueter en petits morceaux d'environ 2 cm^2; faire tremper ensuite dans l'eau chaude pendant une demi-heure.

3. Mettre un peu de papier trempé dans un mélangeur à moitié rempli d'eau tiède, et mélanger à vitesse modérée jusqu'à ce que les morceaux forment une pâte. (Si vous avez des difficultés, enlever un peu de papier.) On peut ajouter à la pâte de petites quantités de matière végétale telle que des épluchures d'orange ou de carotte, ou des fleurs, et mélanger de nouveau.

Pâte colorée: Si l'on désire une pâte colorée, ajouter de la teinture à la pâte. S'assurer que la teinture n'est pas toxique.

4. Verser ensuite la pâte dans une grande cuvette en plastique, à moitié remplie d'eau tiède. L'épaisseur du papier dépendra de la quantité de pâte utilisée.

5. Recouvrir le cadre-moustiquaire (forme) du cadre volant. Des deux mains, plonger la forme dans la cuvette. Secouer doucement la forme pour avoir une couche uniforme de pâte. Une fois l'eau égouttée, retirer la forme de la cuvette et soulever avec soin le cadre volant pour laisser sur la forme la feuille de papier humide.

6. Pour retirer le papier, renverser la forme sur un torchon à vaisselle propre. À l'aide de l'éponge, essuyer l'eau au dos de la forme. Soulever ensuite doucement la forme: la feuille de papier restera sur le torchon.

7. Pour sécher la feuille rapidement, la couvrir d'un autre torchon et la repasser à réglage moyen. Une fois le papier sec, tirer doucement de chaque côté du torchon pour aider à libérer la feuille. Enlever ensuite le papier.

8. Nettoyage: Recueillir ensuite les restes de pâte dans un tamis. Ne pas verser la pâte dans l'évier: il pourrait se bloquer. Mettre les restes de pâte au rebut ou les conserver au congélateur, dans un sac en plastique.

Si vous avez des suggestions à faire ou désirez un supplément d'information, écrivez à: The Printed Word, Printing and Papermaking, Ontario Science Centre, 770 Don Mills Road, Don Mills (Ontario) M3C 1T3

Étude et jeux sur l'environnement

Notre amie l'eau

Eau douce des rivières et des lacs, eau salée de la mer, eau stagnante des marais, eau riante des torrents impétueux, eau de source cristalline, eau de pluie caressante ou violente, eau potable rafraîchissante...

L'eau, c'est tout cela et bien d'autres choses.

On trouve de l'eau presque partout sur la terre. Parfois, elle nous entoure, comme dans une forêt pluvieuse, où elle tombe drue et serrée. Ailleurs, dans les déserts, elle est parfois très rare, et il faut marcher des jours et des jours avant d'en trouver un peu. Souvent, elle est impropre à la consommation, comme par exemple l'eau de mer ou l'eau des grenouillères. Parfois aussi, elle est trop abondante, comme au printemps, à la fonte des neiges, lorsque les rivières sortent de leur lit ou que la glace forme des embâcles sur les lacs.

En Ontario, nous avons de l'eau en abondance, et des milliers de lacs parsèment notre province. L'eau coule dans d'innombrables cours d'eau impétueux de la région du Nord, ainsi que dans les ruisseaux et rivières qui sillonnent les forêts et les vallées du Sud. Lorsqu'il pleut et que l'air devient brumeux et gris, l'eau lave les feuilles et les aiguilles des arbres. L'hiver, en se transformant en neige et en glace, l'eau recouvre la province d'un tapis blanc et cache les couleurs joyeuses de l'automne.

Dans l'eau habitent d'innombrables êtres vivants que nous n'apercevons que rarement. Les poissons et les grenouilles, les palourdes et les tortues en sont les plus gros habitants. Ils se nourrissent de formes de vie beaucoup plus petites, qui vivent également dans l'eau, des créatures si petites qu'une tête d'épingle peut en tenir un millier.

On trouve aussi, mélangés à l'eau et invisibles à l'oeil nu, divers sels et minéraux dont tous les êtres vivants ont besoin pour leur croissance: le fer et le soufre, le calcium et le potassium, et les dizaines de mélanges qui aident les plantes et les animaux à se développer, et l'homme à rester en santé.

Parfois, l'eau contient aussi des éléments nuisibles. Parfois, elle est sale ou mélangée à des rebuts. Le cycle hydrologique de la nature purifie l'eau de façon naturelle.

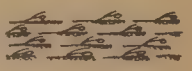
L'eau nous permet de...

nous laver

faire pousser des légumes

cuire les aliments

nous amuser



laver les vitres

nous promener en bateau

faire de la peinture

nous livrer à une foule de jeux

préparer des boissons

laver la voiture

préparer des popsicles

arroser le jardin

faire de la pâte

Le cycle de l'eau

Lorsque l'eau se réchauffe, elle se transforme en vapeur et s'évapore. Lorsque la vapeur se refroidit, elle se condense et se transforme de nouveau en eau, sous forme de pluie. C'est ainsi que l'eau est toujours en mouvement, sauf lorsqu'il fait très froid et qu'elle se transforme en glace. Elle doit alors attendre que le soleil la fasse fondre.

Lorsque la pluie tombe, elle coule sur les arbres, les toits des maisons, les terrains de stationnement et les routes, ainsi que dans les champs. Elle tombe aussi dans les rivières et les lacs, où elle se mélange à l'eau qui s'y trouve déjà. La pluie qui tombe sur les toits des maisons et sur les routes s'écoule dans les conduites d'évacuation, qui l'acheminent vers les cours d'eau et les rivières. L'eau qui tombe sur les arbres et les champs se dépose en gouttelettes sur chaque feuille et chaque brin d'herbe, et les gouttelettes glissent sur la surface brillante des feuilles et tombent de feuille en feuille jusqu'au sol.

Une fois au sol, la pluie se mélange à la terre et se fraye un chemin par les interstices du sol. Elle finit par s'infiltrer dans le sol, jusqu'à ce qu'elle atteigne une couche de roc qui n'absorbe pas l'humidité, ou une couche de matière dense telle que l'argile, qui ne présente presque aucune crevasse pour lui permettre de s'échapper. L'eau interrompt alors sa course et suit la direction de la couche qu'elle n'a pu traverser.

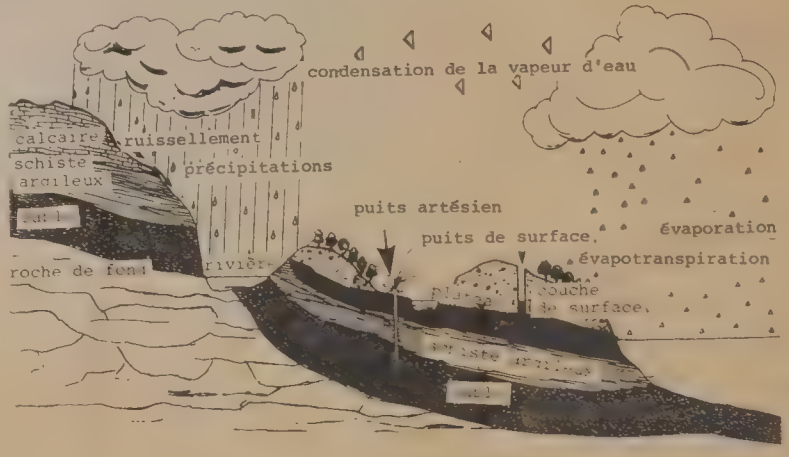
Elle suit alors le mouvement de la surface du sol, qui s'élève à certains endroits pour former des vallées et des collines. Si la couche se rapproche de la surface ou même la brise, l'eau jaillit du sol pour former des sources, qui sont à l'origine des ruisseaux et des rivières.

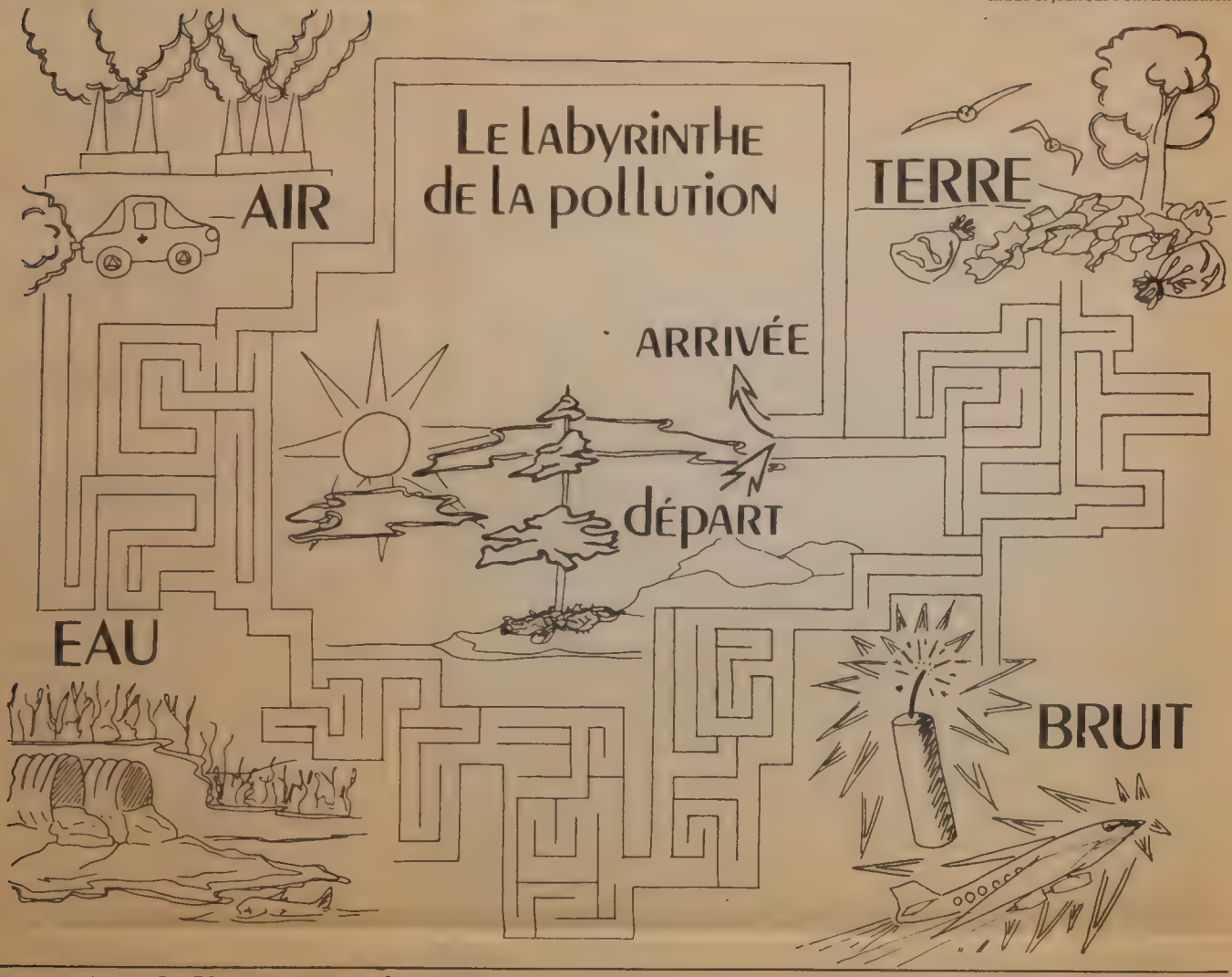
Progressivement, tous les ruisseaux se rejoindront et formeront des rivières, qui à leur tour se jetteront dans un lac ou dans la mer. L'eau des lacs, des rivières et des océans se transforme en vapeur d'eau, qui s'élève et forme les nuages. Poussés par le vent, les nuages se déplacent en suivant les contours de la terre. Plus les nuages s'élèvent, plus la vapeur d'eau se condense, jusqu'à ce qu'elle se transforme en eau, sous forme de pluie.

Les plantes et les arbres participent aussi à ce processus en tirant l'humidité du sol et en la transformant en vapeur. Par ce phénomène de l'évapotranspiration, la vapeur d'eau est retournée à l'atmosphère.

En résumé, l'évaporation de l'humidité des océans, des lacs, des rivières et de la terre, et l'évapotranspiration des plantes forment la vapeur d'eau, qui se transforme en nuages. Les nuages finissent par rendre cette humidité à la terre sous forme de précipitations.

LE CYCLE DE L'EAU





Matériel d'apprentissage d'Environnement Ontario pour le écoles élémentaires.

Le ministère de l'Environnement de l'Ontario distribue du matériel pédagogique à l'intention des enseignants du cycle élémentaire, qui peuvent le reproduire pour leurs élèves.

Le matériel ci-après est déjà disponible:

À l'intention des enseignants (TEd)

TEd Série 1f

Mini-affiche à colorier
Mot caché
Collage
Historiettes

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Introduction aux déchets solides et au recyclage
Ce qu'il faut savoir sur les déchets: activités
La pollution atmosphérique
Études sur le bruit
Comparaisons entre le plancton végétal et animal

[illegible]

Journée de nettoyage
Les arbres de votre ville
L'aménagement urbain
Le terrain de l'école comme ressource pédagogique

TEd Série 4f

La neige vue de plus près
Étude de l'habitat aquatique
Étude du gazon
Plan de leçon pour l'étude du sol

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Guide d'activités pour les promenades dans les bois
Le terrarium
Les déchets solides
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Ed 4 Solutions to Pollution with the Anti-Pollutes of Water Creek - Livre à colorier pour les jeunes enfants.

Ed 5 La famille Pollueur - Jeux pour les enfants sur les pollueurs insouciants.

Ed 6 My Water Book - Livre pour les enfants (K-6) sur le monde de l'eau.

AFFICHES
Edp 3 Affiches Crac sur l'air
Edp 4 Affiches Crac sur l'eau
Edp 5 Affiches Crac sur les rebuts
Edp 6 Affiches Crac sur le bruit

Ed 7 Affiches Crac sur la pollution par les gaz d'échappement
Ed 8 Affiches Crac sur les insecticides

Guides spéciaux à l'intention des enseignants

Les ouvrages suivants ne sont en vente qu'au centre des publications, librairie du gouvernement de l'Ontario, 880, rue Bay, Toronto, Ontario M7A 1N8. Les chèques doivent être faits à l'ordre du trésorier de l'Ontario.

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- Plans de cours sur l'environnement pour les enseignants qui travaillent auprès des enfants handicapés. 160 pages, $2

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- 80 diapositives, avec cassette et texte. Projet réalisé à l'occasion de l'Année de l'enfant. Initiation au plein air et à l'environnement.

Étude et jeux sur l'environnement est publié par le ministère de l'Environnement, Direction des services d'information, 135 ouest, avenue St. Clair, Toronto, Ontario M4V 1P5. Autres exemplaires gratuits sur demande.

Direction.....M.F. Cheetham
Adjoint à la direction.....D. Brockwell
Direction des services d'information.....R.J. Frewin

Envirofacts and Fun

Number 2

No Rainbows in Meadowglade

by Jane Watson

No rainbows had been given out in Meadowglade County for a long time. Mr. Snubbs, the environmental caretaker, usually put up the rainbows whenever Meadowglade County was especially clean and he wanted to show people how proud he was.

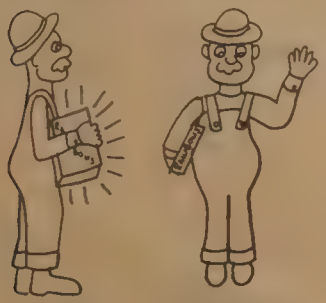
But Mr. Snubbs was still away on vacation.

Every winter he went south to warm his bones and to rest up for the hard work ahead of him in the spring. For it is hard work, you know, to keep the environment clean.

However, this year the people who flew the planes decided to stop flying until they got paid more money. So, Mr. Snubbs was forced to stay down south all spring. Actually he didn't mind too much. He got a nice suntan and, at a certain little store, he was able to pick up some beautiful new rainbows at a special price.

These rainbows were especially beautiful. They were all colours — as rainbows should be — and one even had some stars sewn into the far side.

But one day, Mr. Snubbs finally got so tired of waiting for an airplane that he decided to take a bus home. And he did. He carried the rainbows in a cardboard box tucked under his arm.



The closer he got to Meadowglade, the more excited he became. He bounced happily on his seat thinking of the rainbows he would put up as soon as he got home. Maybe the blue one with the red and green stripes. Or the bright orange rainbow with the yellow circles. He decided to keep the rainbow with the stars for a very special occasion.

But as the bus got closer and closer to Meadowglade County, Mr. Snubbs began to stop smiling. Then he began to frown and soon large tears started to roll down his face. There could be no rainbows for Meadowglade County. The place was a mess. He wasn't proud of it at all.

The air was so full of smoke that the sun couldn't even be seen. The river was dirty and full of garbage. All the houses looked grey. Even the flowers looked grey and all the people seemed tired and unhappy. Pollution had come to Meadowglade County!

Mr. Snubbs got off the bus and walked slowly home dragging his box on the ground behind him. "I should have come home sooner," he cried. "If I had been here in the spring doing my job this would never have happened." And now, Mr. Snubbs' throat began to hurt from the pollution in the air.

When Mr. Snubbs got home he found John, Jennifer and Angela sitting on his doorstep. The year before they had helped Mr. Snubbs keep Meadowglade County clean, or at least they did whenever they thought about it. But now, all three had very sad faces.

"Oh, Mr. Snubbs," said Jennifer, "we thought that you were never coming home again. Meadowglade County has become an ugly place to live now. We were thinking that maybe we'll move to the next town." Jennifer was a little girl who always liked things to look nice.

John, a very wise little boy, shook his head sadly and said, "That's no good. Pollution might follow us there. We can't always keep moving."

Angela just kept crying and large tears fell from her eyes onto the poor, dirty flowers at her feet.

"It's all my fault," said Mr. Snubbs, "I should have come home sooner. I asked Wendy Whistlethwaite the Wind, and Babble Brook the Water, and Peter Patter the Rain to look after things when I was gone. And I thought if you and the people of Meadowglade County helped them, everything should stay clean and beautiful."

"Well," said John, "we haven't seen Wendy, Babble or Peter since last fall."

"When the spring came and everyone saw that the air and water were dirty, they just stopped caring," said Jennifer. "Everyone just gave up."

Angela didn't say anything; she was too busy shedding large tears.

"Is it too late, Mr. Snubbs, to make everything as clean and as beautiful as it was last year?" asked John.

"It probably is," sighed Mr. Snubbs. Then all of a sudden he got a surprised look on his face and slowly, very slowly, he began to smile.

John and Jennifer turned and looked where Mr. Snubbs was looking. He was staring at the ground by Angela's feet. Angela's tears had washed the dust off the ground and off the flowers. You could see that the flowers weren't really grey. They were actually yellow and pink.

"Angela, you've given me an idea," said Mr. Snubbs excitedly. "It's not too late to stop pollution in Meadowglade County, but we'll have to hurry.

Let's see now — what will we need? What will we need? Hmmmm. We'll have to get help," Mr. Snubbs was running around in circles and rubbing his chin.

John and Jennifer looked at each other in amazement. Angela stopped crying.

"Alright now, I've got it," Mr. Snubbs said as he clapped his hands. "First we'll call on Peter Patter, Wendy Whistlethwaite and Babble Brook and get them back to work."

So Mr. Snubbs left the cardboard box full of rainbows on his doorstep and, with John, Jennifer and Angela, ran off to the cave high up on Meadowglade Mountain where the wind, water and rain lived together and played.

When they got to the cave, they looked around in amazement. The land outside the cave was covered in old paper wrappings from hamburgers, empty milkshake containers and old pizza boxes. Inside the cave, it was almost as bad. There were tin cans, straws and serviettes all over the place. There was dust everywhere and the cave didn't even smell nice.

Wendy Whistlethwaite and Peter Patter were busy watching T.V. and munching popcorn. The T.V. was on so loud that they didn't even hear Mr. Snubbs and his friends arrive. Babble Brook was still in bed with the covers pulled up over his head.

Mr. Snubbs was angry, very angry. He stomped over to the T.V. and turned it off. When Wendy and Peter looked up and saw Mr. Snubbs, they got very upset. Both of them jumped up and began talking at once.

"Oh, Mr. Snubbs, what a nice surprise! When did you get home? Did you have a nice trip? We weren't expecting you home so soon," said Wendy. She was trying to be friendly and to get Mr. Snubbs to stop frowning

Peter said, "I was just going out to work in the river, this minute. I have been really busy, you know and I did have a very bad cold last week."

Mr. Snubbs didn't say a word. He just went over to Babble's bed and pulled off the covers. Babble opened one eye, then both eyes, and when he saw Mr. Snubbs staring down at him, he began to shake and try to hide his head under the pillow.

"Oh, no you don't," said Mr. Snubbs firmly, "get out of bed. I want to talk to you, and Wendy and Peter."

"Now what do the three of you have to say for yourselves. You all agreed to help take care of the environment, when I went on holidays, but Meadowglade County is now a dirty, polluted place. People are even beginning to talk about leaving," said Mr. Snubbs sadly.

"Well, we did go out in the spring to clean up after the winter," said Peter, "but we were feeling a little tired and it was such a mess, and none of the people in Meadowglade seemed very interested in making things beautiful."

"We would have helped you," said Jennifer, who was still standing at the cave door with John and Angela

Babble looked at them and laughed. "Oh, we saw you this spring. John was kicking a can down the street. Angela was dropping a chocolate bar wrapper near — but not in — a garbage can, and you, Jennifer, were walking past a popsicle wrapper lying on the sidewalk."

"Well, I didn't drop it there," said Jennifer. "Why should I put it in the garbage?"

"That's the trouble," said Mr. Snubbs. "Everyone waits for someone else to clean up the environment. No one will take the responsibility on himself."

"We were going to go out and clean up Meadowglade just before you came home," said Wendy. "Then you would never have known about the mess and would have put up a beautiful rainbow."

"But, don't you see," said Mr. Snubbs, "you don't have to keep the environment beautiful for me, but for yourselves. Don't you want to see the sun, breathe clean air, sit by a sparkling stream and walk in litter-free streets and parks? Don't you want to be proud of where you live?"

"Oh, yes," said Wendy, Babble, Peter and the three children all together. "Let's start working now."

"It won't be too late, will it?" asked John anxiously.

"No, it's not too late," said Mr. Snubbs. "Angela proved that to me when she washed the flowers clean with her tears. But we'll have a lot more work to do than if we had started keeping the environment clean early this year. However, there's no sense complaining now. Let's get to work."

"Can we take a minute to clean up this place, too?" asked Wendy. "I'm not very proud of it myself, now that I look around. I'll whip around and gather all the litter in one spot and then, perhaps the children will take it to the landfill site for me, where all the garbage goes."

"Of course we will," said Jennifer.

So Wendy whipped around the cave and around the land outside the cave, like the wind she was, and cleaned up everything in no time flat. Peter and Babble, not to be outdone, also went through the cave and washed everything clean in two minutes. Soon the place began to smell nice too.

Then Wendy Whistlethwaite, Babble Brook and Peter Patter, Mr. Snubbs and the three children began to work on Meadowglade County.

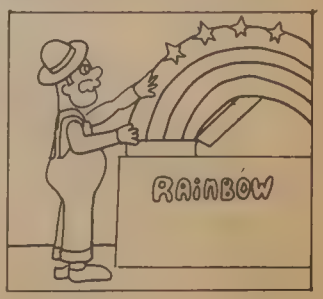
Peter Patter washed the clouds, the flowers and the grass. Soon the sun could be seen shining in the sky and the flowers began to nod happily.

Babble Brook cleaned up the river and deposited all the garbage in one spot on the river bank. Mr. Snubbs and John carted the garbage away to the landfill site. Soon the water looked sparkling clean.

Wendy Whistlethwaite whirled and twirled all over Meadowglade and gathered all the litter together. Jennifer and Angela carried it away.

When the people of Meadowvale saw what was going on and how clean the area was becoming, they all began to help too.

Mind you, even with everyone helping, it still took a very long time to clean up Meadowglade. Meadowglade had been a real mess.



At last, the area was bright and beautiful again.

"Well, thank goodness that's over," said Babble. "Now I can go back to bed. Let me know if I can help you next year."

"Oh, Babble," said Mr. Snubbs, "Didn't you learn anything from this. We all have to keep working on our environment every day, so that it doesn't become an impossible job."

"Well, I've learned my lesson," said Wendy, "and I'll make sure that Babble and Peter keep working also."

"There's no need to remind me," said Peter. "I worked so hard these past few days that I never want to get so far behind in my work again. I'll do my part to keep the environment clean every day."

"So will we," said John, Jennifer and Angela.

"By the way, Mr. Snubbs, haven't you forgotten something?" asked John.

"No, I don't think so," said Mr. Snubbs. "The litter is gone, the water is clean, the air pure. Everything is perfect in Meadowglade ... Oh, wait a minute, John, I know what you mean. I'll be back in a few minutes. I've got work to do."

Mr. Snubbs ran off home and got his box of rainbows. He was so proud of Meadowglade County that he pulled out his favourite rainbow — the one with the stars.

Then, using some magic that he learned from his father a long time ago, he put the beautiful starry rainbow up in the sky.

It was so lovely that all over Meadowglade, people came out of their homes and stood looking up at the sky, and each person quietly promised to himself that he would do his part to keep the environment so that Meadowglade County could always be beautiful and have a rainbow.

Then John, Jennifer and Angela began to yell and dance for joy. Soon everyone was dancing, including Wendy, Babble and Peter.

Mr. Snubbs just smiled and looked proud.

12,000 years ago, Mrs. Ogg didn't know what to do about her garbage.

Ontario
Ministry
of the
Environment

For information on waste management, write:
Information Services Branch,
Ministry of the Environment,
135 St. Clair Avenue West,
Toronto, Ontario
M4V 1P5

We still have problems.

COLOR THIS POSTER AND DO YOUR OWN THING!

J & J's Garbage Lesson

By: Donna Brockwell

It was a beautiful sunny day but Johnny was sitting on the front steps gloomily wondering what he could do, Tim was with his family at their cottage until next week, Paul was at the dentist and Dave was at camp. Johnny didn't even notice a boy walking up the driveway until he was only a few meters away. It was the way the boy was dressed that caught Johnny's eye. Although he was in bare feet and without a shirt, which was normal for a hot day, he wore *fur* shorts.

"Hi" the boy said," I saw you sitting here alone so I thought I'd come over and say hi. I'm visiting my aunt and uncle this week but they're pretty boring."

"I'm glad you did come over. I was wondering what I would do today since my friends are all away. I'm Johnny."

"Hi Johnny. My name's Junior Ogg."

"Well what do you want to do, go for a bike ride? I can lend you my bike then I'll borrow my brothers'."

"Sure, but I've never ridden a bike before."

"You've never ridden a bike before?" Johnny asked, amazed.

"No, you see I lived here 12,000 years ago. That's why I'm wearing these funny fur shorts. Back then, we only had animal skins to make our clothes out of. We didn't have bikes either."

"C'mon, I'll show you how. It's easy!"

Soon, the two boys were cycling along streets heading towards the country.

Suddenly, Junior stopped cycling.

"What's up?" Johnny asked.

Junior stared at the pile of garbage scattered alongside the road. "I can't believe that you still just dump your garbage. We used to do that 12,000 years ago and when the garbage pile got too high or smelly, we moved on. Now, you have airplanes, cars, bikes, spaceships — yet you still dump your garbage!"

"Not everyone dumps there garbage like that!" Johnny said. "That was some stupid person who was too lazy to take their garbage to a sanitary landfill site."

"A what?" Junior asked.

"A sanitary landfill site. There's one just up the street. Let's go. I'll show it to you," said Johnny.

The boys cycled up and stopped by the gate watching trucks driving in. Johnny explained to Junior, "Where I live, a garbage truck comes around twice each week collecting the garbage my family makes. This is where they bring it."

"Hello there. May I help you fellas?"

Both Johnny and Junior turned around to see a large man standing behind them.

"Oh we were just wondering what happens to the garbage after it's collected from our homes," Johnny answered.

"Well come with me and I'll be happy to show you".

They climbed into the garbage truck and sat beside the large man as he drove along the road behind similar trucks.

"At one time," the man called Bob

explained, "garbage was just brought in and dumped. But that was a poor method of getting rid of it. People could smell the garbage kilometers away, it looked messy as papers were blown around in a strong wind, rats lived and breeded there and many diseases were caused by garbage dumps."

"But why don't you burn it?" Johnny asked. Bob smiled, "Can you remember the smell when your mom burnt a dish for dinner? Imagine the smell if we burnt all our garbage. We'd be creating air pollution."

"I never thought of that. Besides, we'd still have the ashes to get rid of."

"So now when garbage is brought in, it's spread over the land, then, when 60 cm. of garbage has piled up or at the end of each day, clean soil is spread on top of the garbage."

"Hey, that's a good idea," piped in Junior, "that would stop all the problems you just mentioned."

"Right, and not only that, when we've finished at one site, grass is laid over top and the land is then used for a park, ski hill or something like that."

"Is this going to be a ski hill? That would be neat!" cried out Johnny.

The boys watched silently as the trucks emptied their garbage and a bulldozer spread it evenly over the land.

"Boy, it sure is a lot of garbage that comes here."

"Did you know," Bob asked "every person in Canada makes 1.8 kilograms of garbage each day. That takes a lot of land for garbage disposal and more important, our natural resources are lost forever when we bury them."

"What do you mean by natural resources?" Junior asked.

"Well, something like aluminum foil. Every time you throw away aluminum foil, you're throwing away the mineral aluminum — There's only so much aluminum in the ground. After we've removed it all, there will never be any more to make products out of."

"Oil must be a natural resource too. My dad said we're running out of oil now," added Johnny.

"So we shouldn't throw away our natural resources then, but use them over and over again," Junior said.

"Hey, I just thought of something. Is that why our newspapers are collected each week, Bob?"

"Right on Johnny. And how about the returnable bottles? In fact, this is what the Ministry of the Environment is working on right now. They're looking for ways which we can use all of the garbage we produce. How would you fellas like to come over to their experimental plant with me? I'm going there now."

"That would be great!" exclaimed Junior.

When they got to the building, called the Resource Recovery Plant in Downsview, Toronto, Bob showed the boys around.

"The garbage collected from homes is brought in here and unloaded" Bob shouted over the noise of the garbage trucks. "Most of the garbage passes along that vibrating conveyor belt where the men remove any large paper objects like cardboard boxes and any possibly hazardous things."

"Hey there's a stove on it Bob!"

"That stove Junior, will be shredded by a 1000 horsepower shredder into pieces smaller than 15 cm. It can shred refrigerators, tires or any large objects.

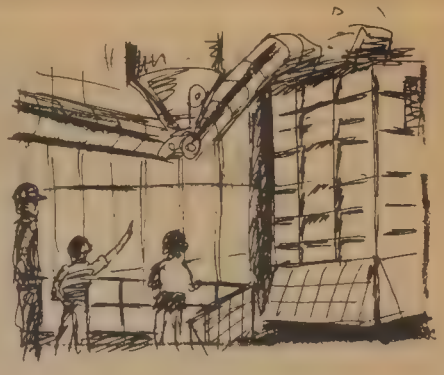
"After the shredder, the stream of garbage passes through an air separator — that tunnel over there. Inside the tunnel is a wind having half the speed of a hurricane! The wind blows away any shredded paper and plastic film which is used to heat this plant or is used to recover paper fiber.

"The heavy stuff still on the conveyor belt is mainly metal, glass and food leftovers.

"Large magnets remove some of the metals while the men over there are picking out the other metals such as brass and aluminum. These are stored then *reclaimed* by industries which require the metals for making new products," Bob explained.

"What happens when the rest of the garbage goes into that drum turning over, Bob?"

"That's where any crushed glass or broken dishes fall through little holes in the drum. The crushed glass is being lifted in those buckets to a storage site until they're sold to industries using crushed glass." "The only thing left is the food," Johnny said, amazed. "Do they do anything with that?"



"Some of the food leftovers or cut grass and leaves from lawns is used to provide energy to run this plant or it's mixed with sewage sludge and put into a composter," answered Bob.

"Hey, we have a composter at home! Every few months, Dad takes stuff out from the bottom and uses it on the garden as a fertilizer."

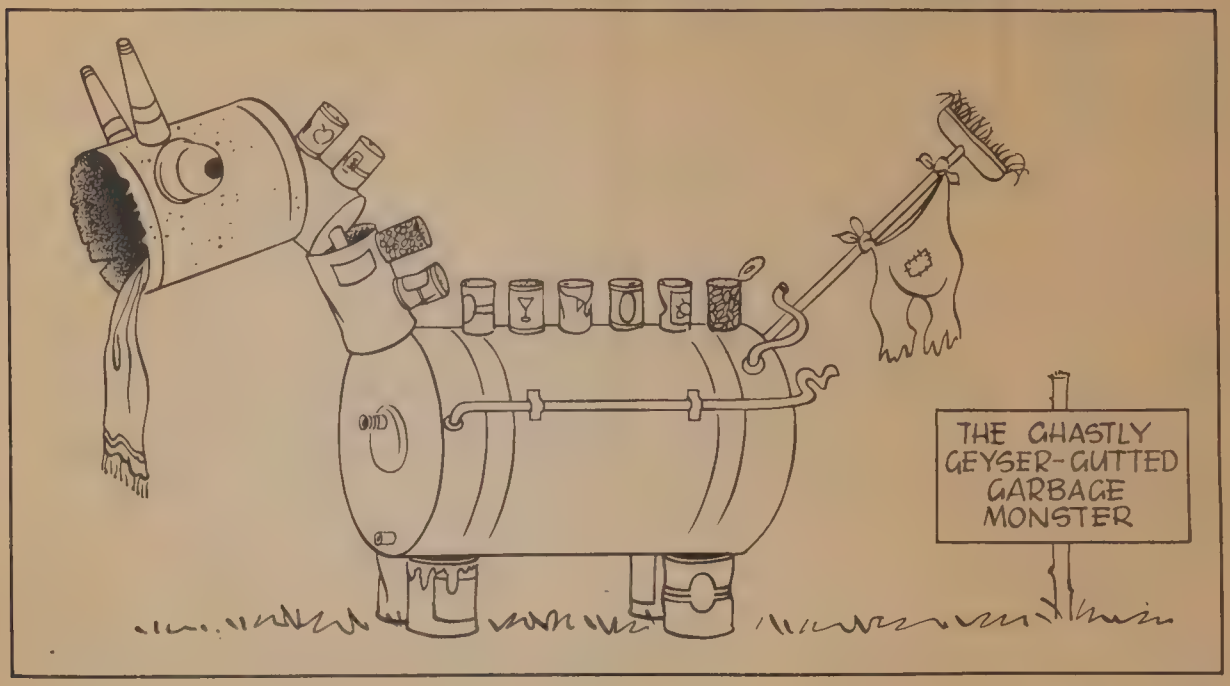
"Exactly, Johnny. So you see boys, almost everything that we have can be recovered. There are still some things that cannot, but we have reduced the amount of garbage going to the landfill site."

"Boy Johnny, garbage disposal certainly has changed from 12,000 years ago," Junior said.

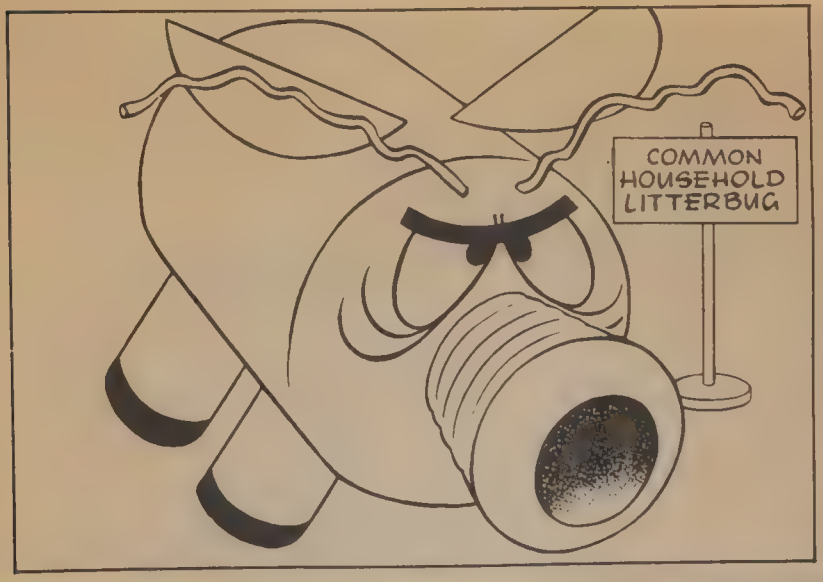
"Yes it has Junior, but it will only work if every person tries."

For some fun, try:
Recycling paper
A paper bundler
Litter Craft
Egg shell Gardens

MAKE A LITTER SCULPTURE!

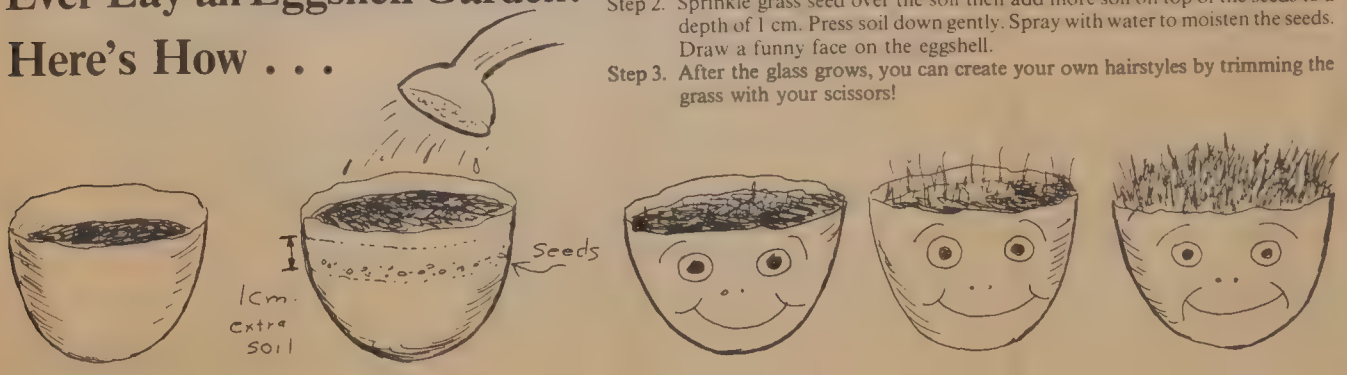


Collect litter and create "sculptures" along lines shown in sketch. Each "sculpture" can be given an appropriate title, such as: THE UGLY LITTER-BIRD . . . THE LOUSY LITTERBUG . . . THE GARBAGE MONSTER . . . depending on the design.

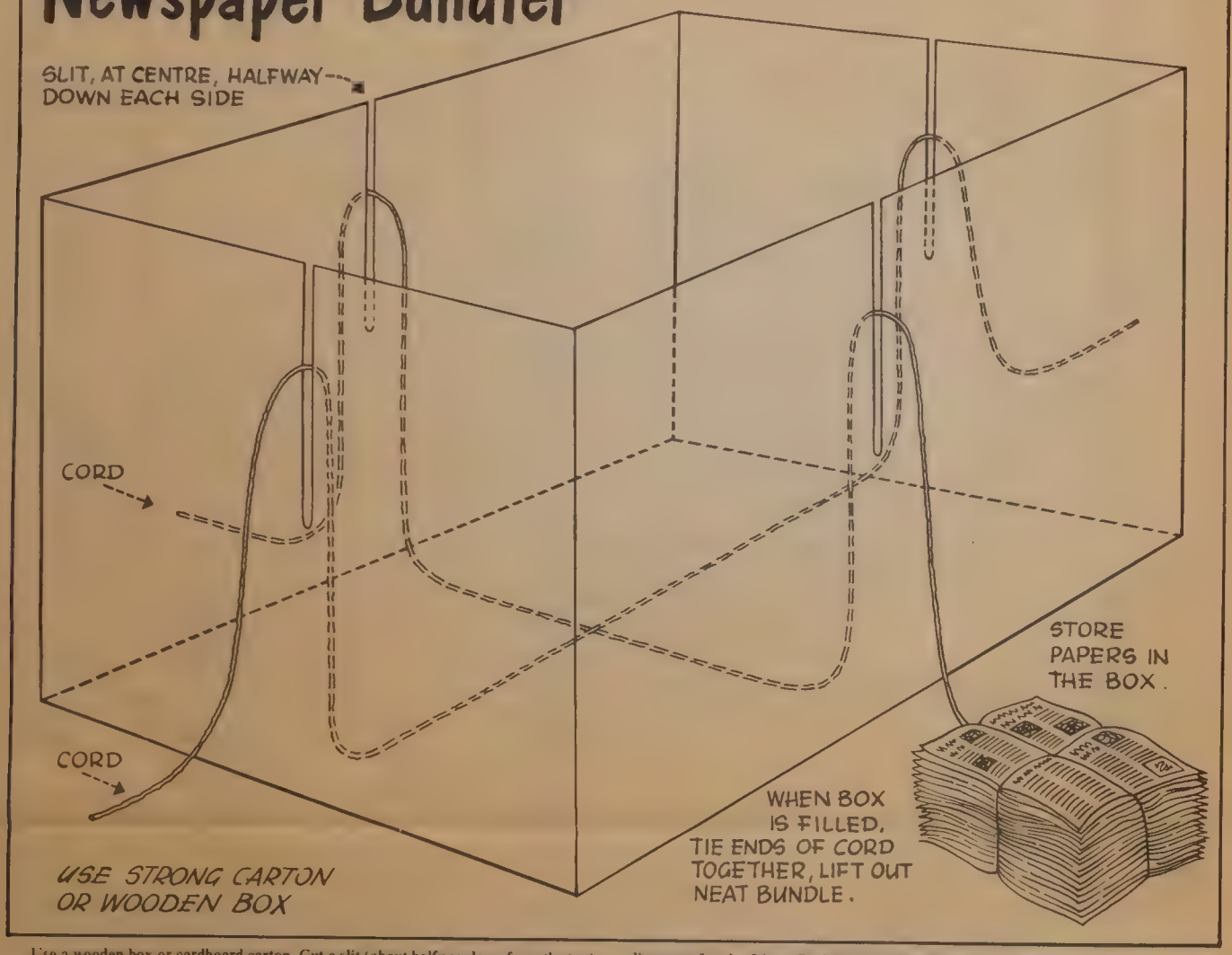


Ever Lay an Eggshell Garden? Here's How . . .

Step 1. Using an empty eggshell or a similar round container, fill it 2/3 full with soil.
Step 2. Sprinkle grass seed over the soil then add more soil on top of the seeds to a depth of 1 cm. Press soil down gently. Spray with water to moisten the seeds. Draw a funny face on the eggshell.
Step 3. After the glass grows, you can create your own hairstyles by trimming the grass with your scissors!



Newspaper Bundler

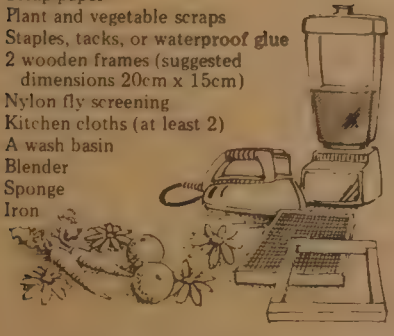


Use a wooden box or cardboard carton. Cut a slit (about halfway down from the top) on the centre of the two sides and ends. Lay two lengths of cord (or baling wire) as shown in the illustration. Store papers in the box. When it is filled tightly, tie the cord or wire ends together . . . and lift out a neatly bundled stack of newspapers, all ready for collection. The diagrams for the Litter Sculptures and the Newspaper Bundler are reprinted with the permission of the Bata Shoe Organization and are part of the joint conservation program of the World Scout Bureau and the World Wildlife Fund.

PAPERMAKING AT HOME

Equipment

Scrap paper
Plant and vegetable scraps
Staples, tacks, or waterproof glue
2 wooden frames (suggested dimensions 20cm x 15cm)
Nylon fly screening
Kitchen cloths (at least 2)
A wash basin
Blender
Sponge
Iron



1 To make paper you must first make a 'paper mould' - a wooden frame with nylon fly screen stapled tightly to it. You can use a second wooden frame (deckle) without the fly screen to help make your paper more even.

2 Take some scrap paper, remove any plastic or staples, tear it into small pieces (about 2 cm square) and soak it in hot water for half an hour.

3 Take a handful of the soaked paper and put into a blender about half-full of warm water. Blend at a moderate speed until you no longer see pieces of paper. (If you have problems, take out some of the paper.) To this mixture (pulp) you can add small amounts of vegetable material like orange peels, carrot tops or flowers, and blend again.

Colouring the Pulp: If you want coloured paper, you can add fabric dye to the pulp. Make sure the dye is non-toxic.

4 Pour the mixture into a large plastic basin, half-full of warm water. Increasing or decreasing the amount of the pulp will affect the thickness of your paper.

5 Place the deckle on top of your screen. With both hands, dip the mould into the basin and scoop up some of the pulp. Gently shake the mould back and forth to get an even layer of fibres on the screen. When the water has drained through, place the mould to one side and carefully lift off the deckle, leaving the just-formed sheet on the screen.

6 To remove the paper from the screen, lay a clean kitchen cloth on a flat table, then take the screen and lay it face down on the cloth. Soak up any extra water from the back of the screen with a sponge. Very gently lift the screen - the paper should remain on the cloth.

7 To dry the paper quickly, cover it with another cloth and iron at a medium dry setting. Once dry, pull gently on either side of the cloth to stretch it - this helps loosen the paper from the cloth. Gently peel the paper off.

8 A CLEAN UP NOTE: When you've finished, collect the left over pulp in a strainer. Be careful NOT to pour pulp down the drain - it might block it. The strained pulp can be thrown out or kept in a plastic bag in the freezer for the next time.

If you have any suggestions or require more information, write to:

The Printed Word,
Printing and Papermaking,
Ontario Science Centre,
770 Don Mills Road,
Don Mills, Ontario.
M3C 1T3

ONTARIO SCIENCE CENTRE

The Water in our World

Water is a rain drop, and an ocean.

Water is a muddy puddle, and a rushing stream.

Water is a refreshing drink, and a lake like an inland sea.

Water is a funny thing.

In most places of the world you will find water. Sometimes it is all around you — as in a rain forest, where it falls from the clouds in almost solid sheets. And in other places it is hard to find — like the desert, where you might travel for days and only find a little. Often the water is not for drinking, like sea water, or the pale green pool where the frogs live. And sometimes there is just too much water, as there is each spring when the snow melts and the rivers burst their banks and the ice forms mountains in the lakes.

In Ontario we have a large amount of water, so much that thousands of lakes speckle the map of our province. Our water flows through countless streams that rush and roar amongst the rock country of the North, and flow quietly and gently between the fields and the woodlands of the South. When it rains, and the air turns misty and grey, our water washes clean the leaves and the needles of the trees. And in winter, as snow and ice, it paints all of the country white and hides the bright, gay colours of Fall.

In all this water teems a life we can only sometimes see. The fish and the frogs, the clams and the turtles are the larger creatures. But they feed on other, much smaller forms of life that also live in the water — creatures so small that a thousand might fit on a pin head.

Also mixed into the water, and invisible to our eyes, are a variety of minerals and salts that all living things need in order to grow. Iron and sulphur, calcium and potassium, dozens of mixtures that help plants develop leaves, animals grow fur, and people stay healthy.

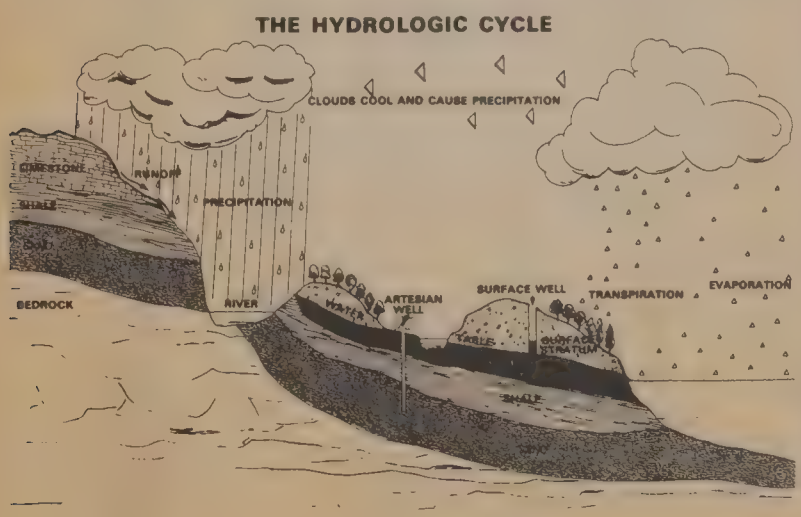
Sometimes, though, there are things in the water that could harm us; sometimes the water is dirty, or has become mixed with a waste. Natures' hydrologic cycle cleans the water naturally.

With Water We:

The Hydrologic Cycle

When water becomes warm it changes to vapour and evaporates — like steam from a bath. When the vapour cools down it condenses and turns back into water — like rain. In this way our water is always moving, except when it is very cold and the water turns to ice. Then it doesn't go anywhere until the sun comes out and melts it.

When rain falls, it lands on trees, rooftops, parking lots and roads, and on fields. Some even splashes into rivers and lakes and mixes with the water already there. The rain that falls onto roofs and parking lots and roads runs away into drains and is led, through pipes, to a point where it can flow into a creek or stream or river. That which lands on vegetation like trees, bushes and fields, settles on each leaf or blade of grass until several drops form together. Then the larger drops run down the shiny surface of the leaf and drop — either to another leaf, or to the ground.



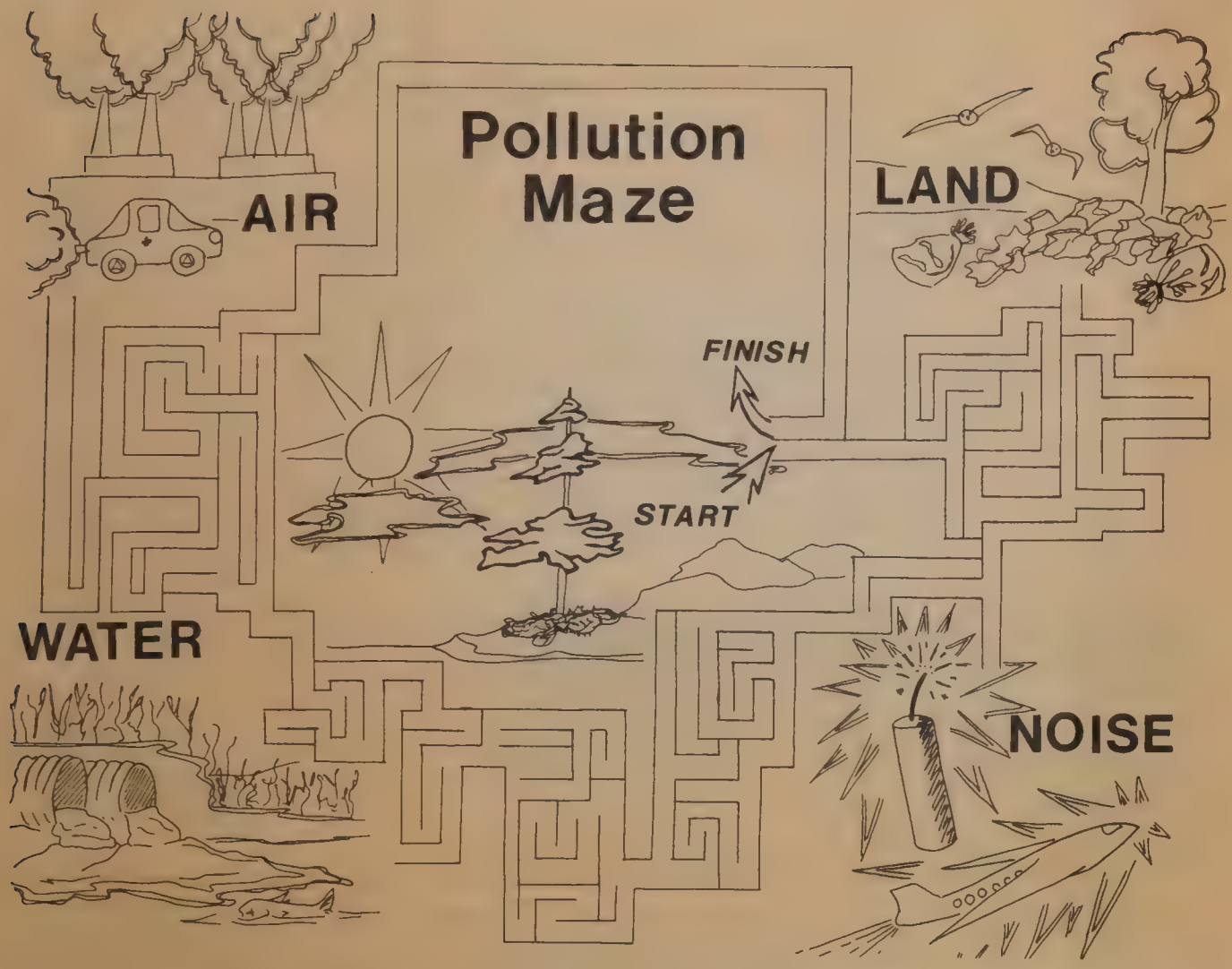
Once on the ground, the rain soaks into the soil, making its way through the tiny gaps between the particles of earth. Sooner or later as it seeps down through the soil, it will come against either a layer of rock that will not absorb moisture, or a layer of dense material, like clay, that has hardly any crevasses for the water to pass through. At this point, the water stops going down into the soil and starts to follow the direction of the layer against which it has come.

As the surface of the ground rises and falls to make valleys and hills, so the water will follow. If the layer comes close to the surface, or even breaks the surface, then the water will run from the ground forming a spring — the start of a creek or river.

Gradually all the streams join together and form rivers, which in turn empty into a lake or the sea. From the surface of the rivers and lakes, and particularly from the surface of the sea, water vapour rises and forms the clouds. Pushed by the wind, the clouds drift and, as the land rises, try to climb over the hills. The higher they go, the cooler they get until they become so cold that the vapour turns back into water. It is raining.

Another part of this process takes place when plants and trees take moisture from the soil and give it off as vapour through their leaves. This is called 'transpiration', and again gives water vapour back into the atmosphere.

In brief, EVAPORATION of moisture from oceans, lakes, rivers and the land, plus the TRANSPIRATION of moisture from plants, forms water vapour which in turn forms clouds. The clouds eventually return this moisture to earth as PRECIPITATION.



Environment Ontario's Educational Materials For Elementary Schools

The Ontario Ministry of the Environment distributes educational materials to teachers at elementary school levels. The fact sheet material may be duplicated by the teacher to provide class sets.

The following is now available:

FOR ELEMENTARY SCHOOL TEACHERS

TEd Set 1E
- Mini Posters for Coloring
- Crossword Puzzle
- Collage
- Stories

TEd Set 2E
- Introduction to Solid Waste and Recycling
- Learning About Waste: Activities
- Teaching About Air Pollution
- Noise Studies
- Comparing Plant and Animal Life in Water

TEd Set 3E
- Clean-up Day
- City Street Trees
- City Planning
- The School Site as a Teaching Resource

TEd Set 4E
- Taking a Closer Look at Snow
- Aquatic Habitat Study
- Lawn Study
- A Lesson Plan for Studying Soil

TEd Set 5E
- Woodland Activity Book
- The Terrarium
- Solid Waste
- Techniques of the Blind Walk
- Organizing the Middle Junior High Laboratory Classroom

(N.B. Please allow a minimum of eight weeks for delivery)

FOR THE STUDENT

Ed 2 Envirofacts and Fun — a game book on pollution in tabloid format

Ed 4 Solutions to Pollution with the Anti-Pollutes of Donber Creek — a coloring book and story about Fran the Toad for young children.

Ed 5 The Glut — a game book for children on thoughtless polluters.

Ed 6 My Water Book — a children's book (K-6) on the world of water.

POSTERS

Edp 3 Ogg Posters — Air

Edp 4 Ogg Posters — Water

Edp 5 Ogg Posters — Waste

Edp 6 Ogg Posters — Noise

Edp 7 Ogg Posters — Auto Emissions

Edp 8 Ogg Posters — Pesticides

Special Manuals for Teachers

The following books are available *only* from the Publications Centre, Ontario Government Bookstore, 880 Bay St., Toronto, Ontario, M7A 1N8. Please make cheques payable to the Treasurer of Ontario.

Ed 7 Environmental Studies for Special Education Teachers
—environmental lesson plans for teachers working with handicapped children. 160 pages. $2.00

Ed 8 From the Lakes ... to the Trees
—An Environmental Handbook for Camp Leaders, 1979 includes field studies, identification guides, games, arts and crafts, poetry and songs. 113 pages. $1.00

Ed 12 Introducing Your Child to Nature
—A handbook for parents and teachers concerning practical lessons on environment to awaken the curiousity of the child. 156 pages. $2.00

Ed 13
—A Citizens' Handbook on Waste Management and Recycling — Free — a compendium of facts and figures on the general subject

Ed 14
—A Citizens' Handbook on Water Quality and Its Protection — Free — a compendium of facts and figures on the general subject

SLIDE SHOWS

Audio-visual presentations may be borrowed from the Ministry on a three week loan period. When requesting, please give six weeks advance notice and alternate dates for viewing, if possible.

Children and Nature

—80 slides, tape cassette and script. a project for the "Year of the Child", the show relates to outdoor education and the environment.

Ontario Ministry of the Environment

Hon. Harry C. Parrott, D.D.S., Minister

Graham W. S. Scott, Deputy Minister

Envirofacts and Fun is published by the Ministry of the Environment, Information Services Branch, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5. Additional copies are available free-of-charge.

Editor ..... M.F. Cheetham
Associate Editor ..... D. Brockwell
Director, Information Services ..... R.J. Frewin

Ontario's Environment Today

A newspaper for high school students

1979

Fight against acid rain continues

Acid rain is one of the latest environmental problems to rear its ugly head.

It is not a new phenomenon, however, for all rainfall is slightly acidic. This is due to the fact that carbon dioxide, which occurs naturally in the atmosphere reacts with moisture to form carbonic acid — a very weak version of soda water.

However, precipitation, both rain and snow, is further acidified when oxides of sulphur and nitrogen react chemically with oxygen and moisture in the atmosphere to form acids.

As acidified rainfall falls on lakes and rivers, changes in the aquatic environment can threaten some fish populations by preventing successful reproduction.

Sulphur compounds are found in various primary ores and in virtually every fossil-fuel including coal and oil upon which urban and industrial society heavily depends

Nitrogen compounds are formed during high-temperature combustion of fossil-fuels.

Since the greater part of the world is dependent upon fossil-fuel, it's not surprising that acidic precipitation is a world-wide phenomenon.

Measurement

The acid content of any solution is defined by the pH scale. Without getting involved in the details of the definition for those not familiar with the scale, it is only important to know that a change of 1 unit of pH represents a 10-fold change in acid content. For example, a lake of Ph 6 contains 10 times more acid than one of pH 7.

A pH value of 7 is a neutral solution — neither acidic nor basic.

Normal rainfall, will have a pH of about 5.6 or greater — just slightly on the acidic side of neutral pH 7.

The pH of rainfall affected by man-made sources may be as low as 3. Such rainwater contains about 400 times as much acid as rain at the normal pH of 5.6.

That describes the basic nature of the problem: sulphur and nitrogen oxides going into the air, being transformed chemically to acids and coming back as excessively acidic rain and snow.

It was well known for years by environmental scientists that atmospheric sources of acid had caused problems in lakes in Sweden, Norway, and New York State. Ministry of the Environment investigations began showing that Ontario was also affected.

In 1976, the Ministry began recording the chemical content of rain and snow in the Muskoka-Haliburtons to determine the quantities of material entering the study lakes. These data are needed as part of a study to measure the effects of cottage development which was and still is a prime purpose of Ministry work.

Since acidic precipitation is a known global problem in the industrialized world, then why the problems in Norway, Sweden, New York and now Ontario?

The answer is that lakes in the Muskoka-Haliburtons and in the other areas mentioned have one thing in common. They are underlain by bedrock which is relatively insoluble with very little capacity to neutralize acidity.

The amount of acid falling in any location is fairly small (about 0.7 pounds of acid per acre per year) and with any significant amount of basic rock in the watershed, the lakes are protected. However, even these small amounts of acid can and do affect

(Rain - continued on page 2.)

The Sydenham High School Environmental Control Group received a grant under the Experience '78 program to build a log cabin, which would later become a community museum. Sitting on beam (left to right): Monica Noble, Joanne Barr, and John Jennings. Below: George Gibson, Doug Henderson, Jeff Peters (teacher), John Hill, Brook Hicks, Kim Kipp and Tony Frink.

New control order changes INCO operations

In July 1978, the Ontario Ministry of the Environment issued a control order governing the operations of INCO Ltd., in Sudbury.

The control order replaces an earlier control order issued by the Ministry in 1970, and permits INCO to emit an average of 3,600 tons of sulphur dioxide per day into the atmosphere. The control order establishes a system whereby meteorological forecasts are used to determine SO 2 emissions on a day-to-day basis. If conditions indicate that the environment may not be able to cope with a higher level of emissions, the company must control and manage production, until the weather changes.

The order became effective July 31st and extends until June 30, 1982.

Erv McIntyre, director of the Ministry's northeastern region, said that INCO must also further control emissions of nickel from the 637-foot iron ore recovery plant stack by mid-1979, and provide an assessment of the extent of low level emissions of SO 2 and other contaminants in the immediate area of its plants.

"We will review our entire INCO LTD. abatement program as we gather more information from our ongoing monitoring programs," said Mr. McIntyre, "and from our six-year study of the impact of the smelting industry on the local environment, the Sudbury Environmental Study, begun in 1974." To that extent, he said, the current control order is seen by us as an interim control measure which reflects the best available information.

"Our information base has expanded considerably in the past eight years," said Mr. McIntyre.

"This body of fact has helped us to both establish effective control programs and to better determine the progress achieved as a result."

Original Program

At the beginning phase of the original Ministry control program established in 1970, INCO was ordered to reduce its sulphur dioxide emissions from 6,262 tons per day to 3,850 tons per day, which it achieved, and to further reduce it to 750 tons by 1978. This 750-ton goal was set in the expectation that new technology would be developed by the company that would make this level of emission control possible. However, the technology has not been developed and the company has suspended

(INCO - continued on page 2.)

Jobs offered under grants' program

Summer jobs. They're always a headache to find. Especially if you're considering a career oriented job. That's thinning out in an already thin field. But every summer the Ontario Youth Secretariat prepares a list of jobs made available by government grants that satisfy many students.

This summer, the Ontario Ministry of the Environment co-ordinated 112 Experience '78 programs, with a total budget of $577,000. Four hundred and ten high school and university students took part.

For the aspiring environmentalists, Environment Ontario prepared a wide range of projects to enhance their understanding of the environment. Throughout Ontario many students worked in the Ministry's laboratories conducting water or air quality experiments, compiling data for evaluation and becoming more familiar with advanced technical equipment they would only be able to find in these labs. Environment Ontario's own technicians and researchers are always handy with advice and a helping hand providing a learning experience in a working situation.

Grants are also supplied to professors in colleges and universities or community groups around Ontario with project ideas related to the environment. This summer these projects included a study of mercury and its effect on memory in animals, building a community environmental centre, studying the recreational use of the Muskoka lakes and promoting the preservation of scenic roads north of Toronto.

At Queen's University, Kingston, two psychology students spent the summer studying the effects of mercury on memory in animals. This is an initial study in the new field of behavioral toxicology. Under the direction of Professor R.G. Weisman, psychology and the environment were combined in an interesting and useful study that will benefit both sciences while giving the students involved a new dimension to their studies

The projects co-ordinated by Environment Ontario are not restricted to the large cities alone. The community interests of smaller towns are just as important. That's why, this summer, ten high school students from Sydenham (population 600), north of Kingston, were given an $8,000 grant to build a log cabin. A local teacher who built his own log cabin is over-seeing the construction. It will be used by the Sydenham High School as a "hands-on" classroom, teaching the basics of

(Jobs - continued on page 2.)

INSIDE FEATURES

INCO issued new control order

(Continued from page 1.)
research after expending more than $14 million on efforts to develop it.

Abatement Measures

The original Ministry abatement program resulted in the erection of a new 1,250-foot chimney to replace three existing chimneys at INCO's Copper Cliff Smelter. The chimney was built and went on-stream in 1972.

To assess the impact of the abatement measures, the Ministry expanded its air quality monitoring network, continued its vegetation surveillance program and implemented an extensive Sudbury Environmental Study, which will be completed by 1980.

Recent reports confirm that air quality at nine air quality monitoring stations in the Sudbury area has met provincial criteria 99.6 per cent of the time during the period 1973-1977. In addition, area vegetation studies indicate that control programs have been successful in halting further damage to vegetation and that sensitive species such as white pine can, for the first time in years, be successfully raised in the area.

Acid Rain

Environment Ontario is gathering extensive data on acid precipitation — a phenomenon caused when oxides of sulphur and nitrogen react chemically with oxygen and moisture in the atmosphere to form acids.

Sulphur compounds are found in various primary ores and in virtually every fossil-fuel including coal and oil upon which urban and industrial society heavily depends. Nitrogen compounds are formed during the high temperature combustion of fossil-fuels.

Since the greater part of the world is dependent upon fossil-fuel, it's not surprising that acidic precipitation is a world-wide phenomenon.

In the Sudbury area, recently published Ministry reports indicate that over 40 of two hundred lakes sampled are acidified and an additional 50 per cent show vulnerability to continuing acidic inputs.

At first thought, it would seem likely that the INCO operations are the major cause of this problem. However, recently collected data does not support this theory.

Upon examining the total emission of SO 2 within the possible zone of effect, it is found that some 2.0 million tons per year comes from other sources in Ontario and northern Quebec and approximately 12 million tons per year from U.S. sources. INCO discharges 1.3 million tons yearly or about 10 per cent of the total.

The impact of NO X gives similar results with 0.6 million tons from Ontario and more than 22 million tons from the U.S. and from Inco — small negligible amounts.

Nevertheless, Ministry studies are presently underway in the Sudbury area to gather sufficient data so that logical, sensible decisions can be made and the necessary abatement strategies undertaken. (For more information on acid rain, see page 1.)

In 1972 under Ministry direction, INCO erected a 1,250-foot chimney at its Copper Cliff Smelter to replace three existing smaller chimneys.

Acid rain — international problem

(Continued from page 1.)
Precambrian lakes such as Clear Lake in Haliburton Township. Lakes in the Kawarthas and Great Lakes chains have good buffering capacity and are not of concern regarding acidification.

To summarize the information in a major report issued last November, it was found that acidic inputs from precipitation are causing some lakes in the Muskoka - Haliburtons to become acidic and that the overall effects in this area are a major concern to the Ministry.

Sources of the problem

To determine the sources of the sulphur and nitrogen oxides affecting the Muskoka-Haliburtons, Ministry staff collect samples of rainfall everytime it rains.

The air resources staff then use weather data to calculate where the air mass came from, which caused the rain. By knowing the amount of rain, acid concentration and the origin of the air mass, they can calculate the impact of sources on a directional basis at least.

Although the data base is far from complete some conclusions can be drawn.

Based on the interpretation of 42 rainfall samples taken in the Muskoka Lake area over the past 24 months, the Ministry has concluded that the majority of acidic material affecting the Haliburton area originates from directions for which northern sources in Ontario and Quebec cannot be implicated.

Of the 42 interpreted rainfall events, nine of these or 21 per cent were found to originate in the northwest direction that could contain a contribution from sources in the Sudbury area. Thirty-three or 79 per cent originated from directions for which Sudbury sources cannot be implicated.

An analysis of the acid loading computed for each event indicated 22 per cent of the total load originated from a northerly direction while 78 per cent originated from other wind directions.

During the recent shutdown of INCO and Falconbridge Mines at Sudbury, the pH conditions in rainfall in the Haliburtons have been as low as any recorded in the past and indeed the overall range of values is about the same as previously reported for times when both smelters were in operation.

One must be very careful in evaluating these data. The amounts of acid falling in any given rainfall, accounting for depth of rain and acid concentration vary up to 200 times. Any conclusions based on few data or short periods of time are not valid. The Ministry's data base of two years is reasonably reliable, but staff still regard the specific numbers as highly tentative. Needless to say, this work in ongoing and can't be speeded up since you must wait until it rains. Only time can resolve the outstanding questions.

Inco

It was recently announced that on an interim basis INCO is allowed to discharge 3,600 tons per day of sulphur dioxide to 1982 — this is down from the 6,000 tons it was discharging in 1970. At first thought, it would seem logical that such a large operation must be the major source of acid in this province. However, rainfall data does not support this speculation.

Upon examining the total emission of SO 2 within the possible zone of effect, it is found that some 2.0 million tons per year comes from other sources in Ontario and northern Quebec and approximately 12 million tons per year from U.S. sources. INCO discharges 1.3 million tons yearly or about 10 per cent of the total.

The impact of NO X gives similar results with O.6 million tons from Ontario and more than 22 million tons from the U.S. and from — INCO — small and negligible amounts.

Many people feel that if we control INCO the acidic rain problem will completely go away. Unfortunately, this is not true as borne out by actual data.

International Co-operation

But such a conclusion about INCO is not very good news, if one is looking for simplistic solutions. It really means that the sources of our problems are numerous, and international in scope — a very difficult situation to deal with.

Abatement programs must proceed on an international co-operative basis.

Last year, the then federal environment minister Romeo LeBlanc said in an address to the Annual Meeting of the Air Pollution Association — "Clearly, this is a problem of concern and one that will get worse if nothing is done — and soon. Despite all the co-operation that exists between Canada and the United States, I believe we have both been negligent in this area. What we have allowed to happen, innocently enough perhaps, is a massive international exchange of air pollutants, and neither party to this exchange is free of guilt."

Provincial Action

Since mid-1975, the Ministry of the Environment has been monitoring the situation and has issued more that than ten individual reports on their findings. As the magnitude of the problem became understood, they moved more and more resources onto the projects.

This year Environment Ontario initiated a joint study with the Ministry of Natural Resources to collect lake samples over a wider area to better define the extent of the problem.

Since there is some preliminary evidence pointing to a possible connection between lake water acidity and mercury uptake in fish, the Ministry of the Environment is entering into a joint project with the Ministry of Natural Resources to further study that relationship. The pilot work has been under way since early July of '78.

Where are all these studies on acidic precipitation leading? First and foremost, they have defined that a problem exists. Sufficient understanding of the problem must now be sought so that effective abatement programs can be designed. There are a host of still unanswered questions which are vital to any abatement program.

To illustrate, simple logic might suggest that if emissions of sulphur and nitrogen compounds are cut back, corresponding levels of acidic rain will be decreased. But there may not be that simple. There is evidence suggesting the quantity of acid formed in the atmosphere may depend on complex variables. That process itself is the focus of intense study by environmental scientists.

The quality of Ministry work to date has been recognized worldwide. Ministry staff have presented papers at European conferences on this subject and several delegations have been in Ontario from Scandinavia to see first hand the work that is underway.

In severely affected areas, the Ministry has conducted experiments on the use of lime to protect the lakes.

Sweden has abandoned its policy of seeking abatement at an international level in Europe and has begun a liming program in some five hundred lakes, using technology borrowed from Ontario.

The Ministry of the Environment is still very concerned for the impact of acidified rainfall throughout the province. And it is for this reason that the Ministry is intensifying and expanding its study of effects so that it can better tackle the complex task of finding solutions.

Summer jobs —

(Continued from page 1.)
energy conservation and environmental protection. The community of Sydenham will also use the cabin as a museum, displaying historical artifacts of the town contributed by local residents and groups.

Four students hired through the Muskoka Lakes Association spent the summer in Ontario's tourist capital studying the ability of Muskoka lakes to absorb recreational development. Such a study benefits cottage owners and tourists alike by determining which lakes can or cannot take more development. This study will go a long way in ensuring that these lakes are not overused to the point that they are of no benefit to anyone.

Using an Experience '78 grant, the Toronto Field Naturalists Club hired nine students to walk the small roads north of Metro. Aerial photographs, maps and foot power were used to find and catalogue these scenic roads. Their preservation in the interest of natural beauty was heavily promoted.

Projects stretch from London to Thunder Bay and Ottawa. Students of every age become involved. They get a chance to meet other students with the same interests while doing something worthwhile for the environment.

Phantom pollutants found in some fish

As well as making a decision on the type of bait, location, and method of fishing, today's fisherman has to concern himself with another factor — how much fish can he safely eat.

Due to both industrial and natural causes, traces of mercury, mirex, and polychlorinated biphenyls (PCBs) have been found in some species of fish in some areas of Ontario.

Prolonged consumption of this contaminated fish can lead to severe illness or, in the case of mercury contaminated fish, to methylmercury poisoning.

Fortunately, these contaminants have never been detected in water in sufficient quantities to make any of Ontario's lakes and rivers unfit for swimming or as a source for treated drinking water.

All three of these contaminants are persistent stable compounds which do not break down in the environment. In other words, even if the source of the pollutant is shut down, traces of the contaminant may still be detected years later. These substances can be absorbed by plant or animal tissue and build up in higher concentrations as they pass through the food chain.

Parts per trillion in water and sediment can become more concentrated in vegetation and aquatic insects and on occasion can reach significantly higher concentrations in predator fish such as lake trout, walleye, bass, and pike.

Ontario is not the only area to experience problems with this type of contamination.

Advances in medical and environmental research as well as improved monitoring equipment have uncovered a growing list of these substances around the world.

Many of these contaminants have been brought into the spotlight in Ontario as a result of a major government sampling and analysis program conducted since 1975 by the Ministries of Natural Resources and the Environment using Environment Ontario's newly expanded sophisticated laboratory facilities to full advantage.

This program, concentrated on the Great Lakes and on recreational water in Ontario, is providing the Ontario government and the public with a comprehensive picture of our water environment. This information, with its good news and bad news, is an essential foundation for pollution cleanup and control measures.

Mercury

Mercury can occur in water and in aquatic life as a result of its presence in the bedrock or the air. Mercury from natural sources has been detected in fish at levels of one part per million or more — twice the acceptable level set for human consumption in Ontario.

Mercury can also be traced to industrial sources. The major sources of mercury discharge in Ontario were four chloralkali plants which produced bleach for use in the pulp and paper industry. In the late '60s, it was discovered that inorganic (metallic) mercury, entering watercourses from these sources, was being converted by bacterial action into organic forms which accumulated in the food chain, reaching high concentrations in fish and in people whose main diet was fish.

Through Ministry of the Environment control orders issued in 1972, the Ministry has effectively eliminated the dangerous discharge of mercury into any Ontario lake or river from all known industrial point sources.

As a result of extensive fish sampling in 1976, elevated mercury levels in fish are being discovered in scattered lakes and systems. In some lakes, notably Simcoe, Muskoka, Lake of Bays, and Lake Joseph, there is no apparent source for the elevated mercury levels. An extended research and sampling priorities program is now being directed in these lakes to track down possible sources of mercury. This includes water and sediment samples from a number of locations on each lake and sampling from sewage treatment plants and other discharges.

Recent monitoring of the St. Clair River, which was closed to commercial fishing in 1970 due to the high levels of mercury, indicates that the levels are now dropping and the river may be reopened in 1982 to commercial fishing.

PCBs

PCBs are man-made substances developed for specific industrial applications. Since they are resistent to chemical change and high in electrical resistance, they have been used as insulating fluid in closed systems such as electrical transformers and capacitators. They have also been used in paints, speciality inks, paper coatings, and plastics.

They have been widely used since the 1920s. It wasn't, however, until the late '60s that it was discovered how stable a compound they are. Items containing PCBs leak and leach their way into the environment. They can also be transported to the air through vaporization or incineration and, consequently, enter the water via fallout or runoff.

They have only surfaced as a problem recently because scientists confused their presence in fish with DDT — a chemically-related compound. (Restrictions were placed on the use of DDT in 1970.)

Laboratory tests on animals indicate that PCBs can affect reproduction, enzymes of the liver, certain hormones, and skin coloring.

The only known manufacturer of PCBs in North America was the Monsanto Co. of St. Louis. After research scientists began raising questions in the 1960s, Monsanto voluntarily limited its sales in 1972 to totally closed systems such as electrical transformers.

The Ministry has served notice to industry that the use of PCBs in Ontario will be phased out and that environmentally-acceptable substitutes must be developed.

The Ministry is also working with major users of PCBs, including Ontario Hydro, to complete inventories of existing equipment containing PCBs to develop measures to eliminate accidental discharges.

PCB traces are evident in fish virtually across Ontario. There are few watersheds totally free of this contaminant, but the most significant area of concern is Great Lakes fish.

Responding to evidence of the hazardous properties of PCBs, Ontario collected and analyzed more than 2,000 fish samples in 1975 and compiled information from ten government and private agencies across North America.

As new testing equipment and techniques are discovered, scientists find new contaminants.

Based on its findings, Ontario advises caution in eating certain species of fish exhibiting PCB levels above the federal guideline of two parts per million.

These include smelt and bass in Lake Ontario's eastern basin and coho and chinook salmon, catfish and eel throughout the Great Lakes.

Ontario advises people not to eat more than an occasional meal of these fish. Women of childbearing age and children should not eat any of these fish.

Sampling data concerning smelt, minnows, suckers, whitefish, walleye, pike, yellow perch, rock bass, and small rainbow trout indicate that these fish are suitable for unrestricted consumption.

Mirex

Mirex is a pesticide used in the control of fire ants.

The chemical builds up in tissue over time and has been identified as a potential carcinogen (cancer-causing agent).

The contamination of certain species of fish in Lake Ontario (the only Ontario lake with detectable mirex levels) has been traced to the operations of Hooker Chemical Company in Niagara Falls, New York which produced the chemical between 1959 and 1967 and packaged it from 1968 to 1975 for shipment elsewhere.

The pesticide Mirex has been used only in southeast United States. It is not licensed for use in Ontario.

Extensive studies conducted at the mouths of Lake Ontario streams and ongoing at industrial refuse disposal sites of the two industries, which imported Mirex from the U.S. firm, have revealed no major sources of contamination on the Canadian side of Lake Ontario.

In July 1976, based on the analysis of more than 750 Lake Ontario fish, Ontario issued a health advisory for species having higher than the acceptable level of 0.1 ppm.

Those include: coho and chinook salmon, brown bullhead, smallmouth bass, catfish, alewife, smelt, white perch and white bass.

In conclusion

Results from the Ontario Government's extensive fish testing program indicate that thousands of Ontario's lakes and rivers are free from significant contamination. Others contain fish that are contaminated to some degree and may be consumed on an occasional basis. Some fish from some lakes contain enough contaminants to make these fish unsuitable for consumption at all. Usually these are the larger, more mature fish that have accumulated the contaminant over a long period of time.

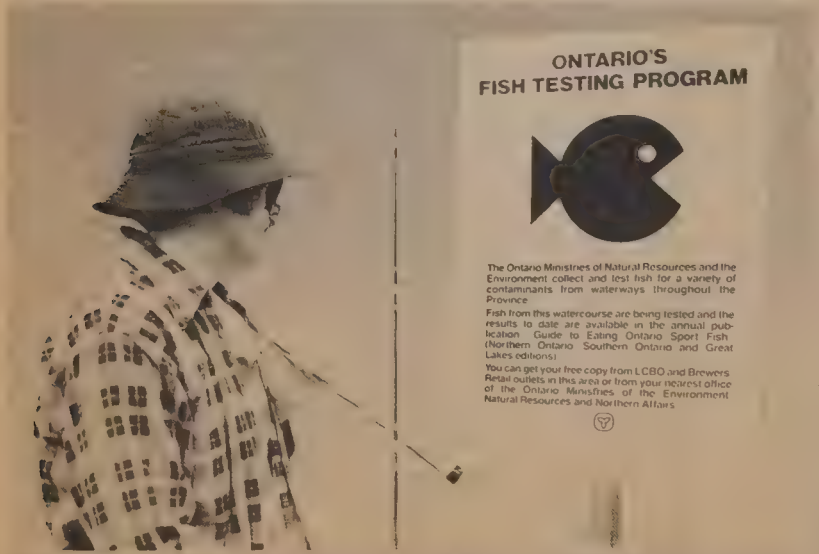
To make the best possible use of Ontario's abundant sports fishery, it is wise to ascertain the state of the fish in your favorite fishing area

Three bi-lingual booklets containing information on fish from waters in Northern Ontario, Southern Ontario, and the Great Lakes have been released to provide anglers with species-by-species and lake-by-lake fish consumption guidelines. These booklets are available without charge from offices of the Ministries of the Environment (see page 12) or Natural Resources.

Additional Reading

1) "Health Implications of Contaminants in Fish", over 150 pages outlining facts about contaminants in fish and listing over 440 lakes and rivers sampled to February 1978. $5 per copy. Send money order or cheque payable to the Ontario Treasurer, to the Ontario Government Bookstore, 880 Bay Street, Toronto.

2) "Your Guide to Ontario's Fish Testing Program", a pamphlet outlining how Ontario's fish testing program is a unique contribution to sport fishing. Free from any office of Ministry of the Environment or Ministry of Natural Resources.



Signs, similar to this one, can be found on lakes whose fish have been tested under Ontario's fish testing program.

Getting old before their time

The map of Ontario shows nearly 250,000 lakes varying in size from under an acre to as large as Lake Superior. More and more of these lakes are being used for summer and winter recreation. By 1970, over 250,000 cottages had been built and since then hundreds more have been added.

Unfortunately, as man puts increasing pressures and demands on his lake he disturbs the water, the aquatic community, the shoreline and speeds up the lake's natural aging processes.

The average stable lake contains a moderate amount of aquatic plants and algae which provide food and a suitable environment for the growth of aquatic invertebrate organisms which in turn serve as food for fish.

Shade from large aquatic plants help to keep the lower water cool — a condition necessary for certain species of fish. The plants also provide protection for young game and forage fish as well as food and/or protection for some species of water fowl.

However, too much plant and algae growth, as well as causing aesthetic and use problems, can create an imbalance in the natural plant and animal community, particularly with regard to oxygen. Very simply, the plants could use up the oxygen required by the fish to survive.

For example, trout require dissolved oxygen levels of at least five parts per million (ppm). When dissolved oxygen falls below this concentration, trout cannot survive. Fish like carp which are more tolerant of low oxygen conditions and which are generally less desirable as sport fish, take over. In extreme circumstances of oxygen depletion, fish kills result.

It is, therefore, important that the natural balance in the aquatic community be maintained.

Balanced diet

Like humans, aquatic plants and algae require a balanced "diet" for growth. Other special requirements including those for light and temperature are specific for certain algae and plants. Chemical elements such as nitrogen, phosphorus, carbon, and several others are required and must be in forms which are available for uptake by plants and algae. Growth of algae can be limited by a scarcity of any single "critical" nutrient. Nitrogen and phosphorus are usually considered "critical" nutrients because they are most often in scarce supply in natural waters, particularly in lakes in the Precambrian area of the province. Phosphorus, especially is necessary for the processes of photosynthesis and cell division. Nitrogen and phosphorus are generally required in the nitrate — N or (ammonia — N) and phosphate forms and are present in natural land runoff and precipitation.

However, excessive amounts of these nutrients can enter the lake from other sources such as municipal sewage plants, urban storm drains, barnyards, industries, septic tanks and from agricultural runoff.

The result of this overfertilization is the premature aging of the lake and the loss of its recreational value.

Other problems

Two other problems which accelerate the decline of a lake are shoreline deterioration and surface-water use conflicts.

Shorelines are attractive to an ever-expanding market of land buyers because they provide access to water recreation. But improper shoreland use can destroy the scenic qualities of a lake and increase erosion problems.

Difficulties also arise when the lake becomes overcrowded. A lake's surface has a limited carrying capacity and conflicts can occur among its users — swimmers, water skiers, skin divers, fishermen and boaters. Industries could also want the lake for a transportation route or need its water for internal manufacturing operations.

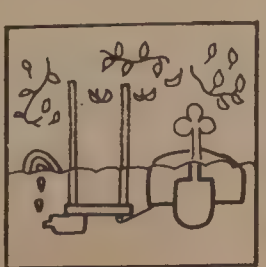
Heavy boating could destroy the shoreline by creating a wave action which erodes banks and deposits a thin layer of silt on the lake floor. This layer can stunt or eliminate aquatic life.

Boat propellors can also uproot aquatic plants which die and fall to the bottom of the lake. The rotting material serves as a fertilizer for future weed growth and uses up valuable oxygen in the decomposing process.

All internal combustion engines produce exhaust gases and as much as 20 per cent of the fuel is lost in an engine's smokey exhaust. The emission contains four main components: organic hydrocarbons, carbon monoxide, lead and nitric oxide. Although they are all toxic, lead is the worst because it is non-biodegradable and tends to accumulate in aquatic life.

Fuel spilled into the water has different effects than exhaust gases. Over a period of time, the gasoline usually evaporates, leaving a thin film of oil or an emulsion of tiny suspended particles on the surface. This film affects the reproduction of plankton, the primary food of most aquatic life and hence upsets the lake's ecosystem.

A thin surface film of oil also prevents the necessary transfer of oxygen from the air to the water.



In Conclusion:

Solving lake problems can be a complicated and expensive business. At present there are a variety of lake renewal and management techniques. Some are being used now, while others are only in experimental stages.

Unfortunately, lake rehabilitation is not always possible. We must therefore work together — government, industry and the individual — to protect and preserve our existing water heritage.

Additional Reading

About Cottage Pollution Control (a fact sheet) Environment Ontario
Weed Harvesting in the Kawarthas (news release) Environment Ontario
Water Pollution — What Can I Do? (fact sheet) Environment Ontario
Why All the Fuss About Phosphates (pamphlet) Environment Canada
Environment Ontario

Film

Lake Odyssey, 27 min., colour, 16 mm.
Dramatizes the restoration of one of Ontario's lakeland playgrounds — the Kawartha Lakes.
Shows how aquatic vegetation can be controlled and reduced by the use of weed harvesting and minimal amounts of chemical herbicide.
Available through Ministry's regional offices (see pg. 12) and from Modern Talking Picture Service, 1875 Leslie Street, Don Mills, Ontario M3B 2M6.

WATER POLLUTION — WHAT CAN I DO?

Water is man's most precious resource. But like other resources, it is not limitless. Clean water, necessary for drinking, recreation and the survival of aquatic life, can only be maintained if we use it wisely.

We borrow water. We must return it as clean if not cleaner. This can be done if we are prepared to put forth the necessary personal and financial efforts.

We all use water. Thus we must all accept the responsibility for pollution. We must help with the task of remedying the causes.

Government and industry are swiftly designing and implementing pollution abatement projects costing millions of dollars.

But what about you? What is your pollution ethic?

What Can I Do?

(1) Inform yourself and your family about the causes of pollution and its dangers.

(2) Join and support citizen groups in working for better water quality.

(3) Check your personal water habits when fishing, boating and picnicking. Keep river banks and shorelines clean.

(4) Don't leave water taps running unnecessarily. The water you are using doesn't belong solely to you.

(5) Measure detergents carefully. This significantly reduces the problem of phosphate pollution.

(6) Use soap flakes or phosphate-free detergents whenever possible.

(7) Check your septic tank annually.

(8) Fill outboard motors carefully. Don't drain oil or gas from power mowers or other machines into sewer systems or water courses.

(9) Never flush away what can be put into the garbage. Some objects cannot be broken down in water and cause serious pollution problems.

(10) Report violations of pollution abatement regulations to your local health department, the police or the MInistry of the Environment.

It's your water. Protect it!

Environment Ontario's self-help program for cottagers enables cottage owners to get involved in the testing of their lake's water quality.

By using an airborne thermal infrared linescanner these thermal plumes were found at the Bruce Nuclear Power Development Site on Lake Huron in April of '78. The white indicates hot spots, the black shows the cold areas.

THERMAL PLUME DATA COLLECTED

One of the side effects of society's desire for an easier way of life is thermal pollution

Some industries, particularly the electric power industry, need water as a coolant for their industrial operations. Most of the water is then returned to its natural source — a river or lake — but is by this time usually warmer than the receiving body.

Thermal pollution exists if this heated water begins to impair the natural aquatic processes.

All aquatic life (micro-and macro-organisms, plants and animals) can be affected by increased temperature, if not directly, then indirectly. For an ecological system is in a delicate balance and damage to any one component can disable or impair the efficiency of the whole mechanism. For example, if one species of fish should be wiped out because of thermal pollution, an important link in the food chain would be dissolved, causing havoc in both the species that it preys upon and on the species that requires it for survival

Effects on fish

Fish are cold-blooded animals, which are unable to regulate their own body temperature.

According to a study on the temperature requirements of aquatic life, it appears that:

1) As water temperature rises, it holds less oxygen;
2) As the water temperature rises, aquatic organisms require more dissolved oxygen to maintain a normal existence, or to survive at all;
3) The temperature requirements of a certain species of fish vary throughout its life history;
4) Lethal high and low temperatures vary widely for different species;
5) Sudden changes in water temperature can be lethal to fish and other aquatic organisms;
6) Within certain limits, fish can acclimate themselves to higher or lower water temperatures;
7) Fish become acclimated to higher temperatures much more rapidly than they do to lower temperatures;
8) Water temperatures do not have to reach lethal levels to wipe out a species. Temperatures which favor competitors, predators, parasites and diseases can also destroy a species;
9) Some fish will swim into hot water in which they are killed, although they might just as easily have swum into water, which would have been harmless; and
10) Temperature influences all the vital processes, including activity, feeding, growth and reproduction.

Disposal Practices

Research is currently underway to find practical methods of using this waste heat for constructive purposes rather than discharging it into a body of water and risking damage to the aquatic ecosystem. Unfortunately, there are few practical applications for its use at present

Current methods to dispose of the waste heat in a relatively safe manner involve the discharge of the heated effluent into the body of water from which it was taken There the effluent, since it is warmer and consequently lighter than the receiving water, spreads in a plume over the surface and is carried off in the direction of the prevailing surface currents

The resulting dispersal of heat through the receiving water and into the atmosphere depends on a number of natural factors: the speed of the currents, the turbulence of the receiving water (which affects the rate of mixing of the effluent with it), the temperature difference between the water and the air, the humidity of the air and speed and direction of the wind

The most variable and most important factor is wind: other things being equal, heat will be dissipated from the water by convection three times faster at a wind speed of twenty miles per hour than a wind speed of five miles per hour

Ministry Responsibility

The Ministry of the Environment is responsible for setting requirements that would minimize the impact of industrial operations upon the environment

All companies must obtain from the Ministry, certificates of approval for the environmental control facilities, which they intend to use to ensure that their emissions into the natural environment will comply with the standards and objectives set by the Ministry.

In addition, to issuing the certificate of approval, the Ministry also asks the company to undertake both pre- and post-operational studies on the body of water concerned. In the case of Ontario Hydro, the largest contributor to thermal pollution in the province, these studies usually run for three years before the plant is constructed and three years afterward. Annual and summary reports are submitted to Ministry staff.

The data and results obtained from the post-operative surveys are compared with the pre-operation mode. If significant potentially serious charges appear to be occurring, the operating methods at the power facility must be altered to reduce the change to acceptable levels. If such an operating change is required, the study period is extended to ensure that the effect is as desired

The Ministry also carries out its own water quality monitoring tests. Since the late sixties, it has relied upon a variety of measures to gather specific water quality data on thermal plumes: dye tracing, moorings, drogue tracking, and overboard thermistor arrays in moving boats. It has also undertaken conventional water sampling for nutrients, chlorophyl a, bacteria, temperature and transparency

More recently, airborne remote sensing techniques have proved more practical. Thermal infrared scanners are not only more advantageous with regard to cost but they can define temperature distribution within the entire plume simultaneously

As new information is acquired on the effects of power plant cooling systems, the Ministry updates and revises its criteria and guidelines for wastewater discharges

Ministry staff are also presently working with representatives from the Federal government to set national temperature guidelines for steam-electric generators at power stations

For further information contact:

Energy Probe
43 Queen's Park Crescent East,
Toronto, Ontario

Dr. L. Moore,
Hydro Projects,
Water Resources Branch,
Ministry of the Environment,
4th Floor, St. Clair Avenue West,
Toronto, Ontario.

Dr. W.R. Effer,
Supervisor, Energy and Environmental Studies,
Ontario Hydro,
700 University Avenue,
Toronto, Ontario
M5G 1X6

Mining industry faces waste disposal problems

Ontario is one of the richest mining areas in the world. At present, it has over one hundred significant active mining operations; most of which are located in Precambrian rock that forms part of the Canadian Shield.

Most mining companies work metal deposits; a few non-metal. Some of the materials being recovered on a commercial basis are copper, lead, zinc, iron, uranium, gold, silver, platinum, cobalt, nickel, palladium, iridium, rhodium, ruthenium, asbestos, talc, and nepheline syenite.

Massive production of substances such as cadmium, tin, titanium, the rare earths, coal, phosphates, and a host of others have also been carried out or will be carried out in the future.

Mining operations in Ontario are extremely diversified. Small open pits mined or operated by one or two individuals exist in the thousands yet the Province also has some of the largest man-made open pits in the world. The underground mines are in a similar situation. Some go as deep as 50 feet while others are worked well below the 5,000-foot mark.

With these differences then, it is no wonder that the mining industry, as well as the provincial government, have to face a variety of mine-mill waste treatment problems.

In Ontario, a mining operation produces two types of primary liquid effluents: I) the mill slurry and, II) the mine water.

I) The Mill Slurry

In Ontario, any mill slurry produced by a mine-mill operation must be directed to an engineered impoundment area (tailings disposal site). A common size for these areas is from one hundred to three hundred acres. A tailings dam, generally less than 50 feet high, surrounds the area to prevent the migration of abnormal amounts of suspended solids from the site into adjacent watercourses.

Generally, the dams are constructed of an impermeable material. If this is not possible, all seepage flows from the bases of impermeable dams should be collected (a trench system is a good method) and treated.

In the early days of mining, lakes were often used as disposal sites. This is no longer regarded as acceptable, unless no other alternative is feasible. In fact, all tailing areas should be located as high in a watershed as possible

Some adverse environmental situations, such as the problem of acid mine drainage, does not reach a peak in Ontario until after a mining property has been abandoned.

In Ontario, waste treatment must continue as long as a problem exists. For this reason, many abandoned mining operations in the Province are equipped with complete automatic waste treatment facilities that function in both winter and summer

II) The Mine Water

Mine water is another source of primary effluent generated by the Ontario mining industry.

In this Province, since they remain

(Continued on page 8.)

Saving our resources. . .

Located on an 18-acre site in northwestern Toronto, Environment Ontario's Experimental Resource Recovery Plant is Canada's first complete recovery system and one of the few anywhere in the world.

When Metro Toronto's garbage arrives at the plant, it is pushed from the receiving floor to the main conveyor belt for processing.

Ontario's $15 million experimental recycling facility, Recovery, was officially opened by Premier William D

The Experimental Plant

The Centre, at 35 Vanley Crescent in Downsview, recovery plant and also as a complete experimental wast centre.

It provides a steady flow of recovered raw materials f products and fuels from waste.

Sophisticated instrument constantly monitor the con materials and the efficiency and productivity of all pla

The flexible design and construction of the plant and t ing will provide valuable information for the design and recovery plants.

In addition, the Centre provides a training facility for o as an information centre for resource conservation.

The resource recovery plant can process up to 60 cardboard and paper, baled shredded mixed paper, shr usable either as raw material or fuel, and organic co process rejects

Since March of 1977, the Centre has been operational of waste are compacted into transports for hauling to l

The plant receives general refuse and paper from Tor and cardboard collected through municipal pick-up or baling station via special conveyor. Once baled the paper

The remaining waste is sent through the resource rec and separated into various elements.

Paper fibre is one such element. It can be stored for us markets for processing into pulp.

Organic materials separated in the resource recovery energy source or mixed with sewage sludge at 55 degree large composter. Biological action transforms this mix

The plant was designed and built by Kilborn Limited staff of 30 employees of Browning-Ferris Industries o

Administration and Research

Administration offices for the Centre are locate Downsview. Some market research on recyclable mat

Laboratories at the plant itself are used to analyze the in the resource recovery system.

Tours of the plant are available by calling the offic

Ontario's Resource Recovery Program

Established in 1974 to combat the growing waste prob Program has four major long-term goals:

- to reduce the quantity of waste produced;
- to recover to the greatest extent practical, resource mat in waste;
-to develop means and markets to reuse recovered materi and compost;
-to reduce to a minimum the use of land for waste dis

Waste is a municipal responsibility. Environment On cal assistance to communities and private industry to he management program, including future resource reco

Waste paper is recovered from the garbage and is bale transportation to available markets.

acility, the Ontario Centre for Resource
liam Davis on August 1, 1978.

view, serves as a full-fledged resource
al waste processing facility and research

erials for use in the development of new

ne consistency and quality of separated
all plant processes.
t and the information from this monitor-
n and practical operation of future waste

y for operators of future plants and serves
on.
to 600 tons per day to produce baled
er, shredded paper and organic fibre, all
nic compost, glass, ferrous metals, and

tional as a transfer station. Up to 900 tons
ng to landfill sites daily.
m Toronto and outlying areas. The paper
up or by industry are sent directly to a
paper is stored for shipping to markets.
ce recovery process where it is shredded

for use as an energy source or shipped to

covery process can also be burned as an
degrees C (130 degrees F) in the Centre's
is mixture into a rich soil conditioner.
mited and is operated under contract by a
ries of Toronto Limited.

located at 4375 Chesswood Drive in
le material is also done here.
yze the composition of material separated

e offices at (416) 636-8015.

e problem, Ontario's Resoruce Recovery

ce material and energy values contained

materials in recycled products and as fuel

ste disposal.
ent Ontario provides financial and techni-
y to help them organize an efficient waste
e recovery facilities.

The $15 million Centre is a solid waste recovery plant, a research and development centre and a municipal transfer station for Metro Toronto. This is a view of the commodity and energy recovery building.

is baled and loaded into trucks for

The plant is controlled from a central control panel in the plant's commodity — energy recovery building. The operator can view working areas of the Plant by the use of a closed circuit television camera and monitors.

Three tiers of government handle environmental issues

To gain a full insight into environmental issues, one has to take a good look at environmental law and legislation.

At first, the division of powers between the federal and provincial governments seems confusing. However, the breakdown of responsibilities was decided by our forefathers in 1867 through the British North America Act.

They decreed that the federal government had the right to make laws concerning anything considered national in scope at the time of confederation. Specifically mentioned are navigation and shipping, sea coasts and inland fisheries. Anything relating to local or private matters was to be under the jurisdiction of the provincial government.

Although there does tend to be some overlapping of responsibilities, the different levels of government do try to work together.

Federal Legislation

The federal Canada Water Act, 1970 and The Clean Air Act, 1971 were designed to create nationwide environmental standards for Canada's air and water quality.

Laws relating specifically to pollution, particularly water, come under The Fisheries Act and The Navigable Waters Protection Act.

The Environmental Contaminants Act enables the federal government to prohibit or restrict the "importation, manufacture, distribution, sale, use, or release" of any substance in Canada which may pose a threat to the environment or to human health.

Ontario's Environmental Legislation

Environmental law in Ontario is based on The Environmental Protection Act, 1971, The Ontario Water Resources Act, 1967, The Pesticides Act, 1973, The Environmental Assessment Act, 1975, and The Public Health Act.

The Environmental Protection Act covers all types of pollution, forbidding the discharge of any contaminant to the natural environment in amounts, concentrations, or levels exceeding those prescribed by regulation. The definition of contaminant includes a solid, gas, liquid, odour, heat, sound, vibration, radiation, or combination of any of these, resulting directly or indirectly from the activities of man, which may cause injury to humans, flora, or fauna.

In addition to regulated limits for specific contaminants, the Act prohibits any discharge that is likely to impair the natural environment, injure or damage plant or animal life, cause harm or discomfort to any person, affect the health or safety of any person, or render any property, plant, or animal life unfit for use by man.

The Act authorizes the Ministry's designated provincial officers to enter and inspect properties to investigate potential sources of pollution. Pollution abatement equipment may be installed on a voluntary basis by the owner of a pollution source or the owner's abatement measures may be formalized by the submission, to the Ministry, of a control program to prevent or reduce and control the emission of a contaminant. It also authorizes a director of the Ministry to issue control orders requiring specific abatement measures for the protection of the environment or human health or requiring the owner to take whatever measures are required to stop the emission of a contaminant, up to and including the suspension of plant operations.

Anyone proposing any project which would emit excessive contaminants to the environment is required to apply for and secure a certificate of approval and to install any required pollution control measures before operations can commence.

Various provisions of the Act cover air pollution control, including automotive emissions, the control and certification of waste handling and disposal systems and sites, and the inspection and certification of private sewage systems by the Ministry. Amendments were made to the Act in 1975 to provide legislative authority for municipal noise control bylaws.

The Ontario Water Resources Act gives the Ministry of the Environment extensive powers to regulate water supply, sewage disposal, and the control of water pollution. It authorizes the Ministry to supervise and examine all surface waters and ground waters in Ontario, to determine the extent, nature, and causes of contamination in these waters.

Under the OWR Act, any discharge into a body of water, on its shore or in any place that may impair the quality of the water is an offence. It is also an offence to make any discharge which directly or through a derivative causes injury to a person, animal, or bird through the use or consumption of any plant, fish, or other living matter in the water.

Certificates of approval and installation of any required pollution controls are necessary for any persons, industries, or municipalities drawing from a body of water or discharging waste into it.

The Ministry can construct and operate water waste treatment facilities, or it can require an industry or municipality to contruct and operate approved facilities.

Water quality criteria have been established as acceptable standards for the various uses made of water.

The Environmental Assessment Act provides for an examination of the potential impact upon the environment of any proposed major undertaking, governmental, municipal, or private, at the very earliest stage to permit alteration or even cancellation of the undertaking should it be environmentally unacceptable. It also provides for full public participation in the decision-making process. It is being implemented in stages, applying first to major provincial undertakings. Specific private projects which involve significant environmental effects may be designated for assessment.

Under the Act, any proponent of an undertaking submits to the Ministry an environmental assessment on the proposal. All interested parties are given an opportunity to examine this document and may request that a public hearing be called by the Environmental Assessment Board to be established under the Act.

The Minister of the Environment, at his discretion, may deny any such request if he considers it to be frivolous, vexatious or that hearings could cause unnecessary delay to an environmentally-acceptable undertaking.

The Environmental Assessment Board has decision-making powers when public hearings are held. The Minister and Cabinet serve as final arbiters of the Board's decisions.

The Pesticides Act restricts the storage, distribution, sale, and use of pesticides. The Ministry examines and licences professional exterminators and maintains a classification system to ensure that hazardous chemical pesticides are not handled or used by unqualified persons.

A fifth piece of provincial legislation is *The Public Health Act* which empowers the local Board of Health and the Medical Officer of Health in each community to take action against anyone who causes a nuisance or runs the premises where a nuisance is created. (This could also include the closing of the building.) A nuisance is defined as "any condition existing in a locality that is or may become injurious or dangerous to health".

Municipal Legislation

Municipalities are generally responsible for sewage treatment, garbage collection, noise regulation, and land-use planning matters. However, their right to pass legislation, or bylaws, is granted to the individual municipalities by the provincial government through The Planning Act and Municipal Act. Hence, their range of powers varies widely from place to place.

The division of legislative powers between the three levels of government may seem confusing to the layperson.

Steps in the Ontario Legislative Process

New laws come from two sources: the civil service or from a member of the provincial parliament.

The proposed legislation is given a number and becomes a Bill.

The Bill must pass three readings in the legislature. The first reading tables or introduces the Bill to make it public and puts it on the House's agenda. At this time, the Minister responsible gives a short explanation of the Bill's contents.

This is an important time for the public. After the Bill has been introduced, a particular interest group can make their views on the subject known by having their MPP refer the proposed legislation to a Standing Committee for consideration after the second reading.

The second reading involves a debate in principle. The Minister may make a speech to start the debate and one to close it. Each MPP can make one speech. No amendments may be made to the Bill at the second reading.

During this period, upon the request of an individual member, the Bill can be sent to the Committee of the Whole House or a Standing Committee as the Minister responsible directs.

If the Bill is sent to the Standing Committee it is considered section-by-section in detail and amendments are made as desired by the Committee. The Bill may not change "in principle". Mem-

(Continued on page 9)

Mining — waste disposal problems

relatively dry, active open pit operations do not generally cause serious wastewater pollution problems.

However, most of the water pumped from such an operation is usually contaminated and requires treatment. The degree of contamination depends on 1) the composition of the ore, 2) the surface area of ore available for chemical attack and, 3) the length of time the water remains in the pit.

Abandoned open pit mines will fill or partially fill through natural precipitation and groundwater flows. Over a period of years, unless all the original ore has been removed, the pit water can become highly contaminated from the remaining sulphides in the wall rock.

In active underground mine operations, water gains access in two ways: as downward percolating groundwater and as water that is deliberately pumped into the workings by the company for process use.

The water that percolates through sulphide or sulphide-associated deposits may bring oxygen, among other substances, into direct contact with the sulphide ore. The sulphides react to produce water soluble salts and sulphuric acid.

Underground mine water is contaminated by the mining process itself. Rock-breaking creates 'fines' that become suspended in underground flows. Trace quantities of the organics (lubricants, oils, etc.,) that are associated with mining machinery frequently end up in underground water. A few parts per million of water soluble explosive materials (amonium nitrate, etc.,) are normally detected in underground flows. In fact, any water soluble substance that is taken underground for any purpose can be expected to appear, sooner or later, in the mine water.

All underground water generally flows to one or more underground sumps. The water is pumped from these collection areas to the surface for disposal.

It is important to note that in Ontario many mining operations subject their collected underground mine water to a degree of waste treatment before it is pumped to the surface. Commonly, some of the suspended solids are removed using various settling mechanisms.

Abandoned conventional underground mines in Ontario are generally allowed to flood. Only on very rare occasions will water overflow the shaft collar. In addition, the shaft will usually be capped with concrete.

If an abandoned mine is being operated on a caretaker basis, and if the workings are kept dewatered, then a continuous or semi-continuous mine water effluent can be expected. This flow is generally contaminated.

The chemical characteristics of mine water vary from mine to mine, from deposit to deposit, and from camp to camp. Since, in Ontario, a mine is almost invariably near a body of water, mine water problems are commonly expected. Experience has shown that mine

(Continued on page 12.)

Air pollution

A sign of the times

In this era of increased dependence upon technology, the average citizen is well aware that the air about him is not as fresh and as pure as he would wish.

The problem is pollutants — foreign materials which have an adverse effect on plants, people, or animals.

Three man-made processes which can cause air pollution are: 1) combustion, 2) vaporization and 3) mechanical attrition.

The types of pollutants emitted from these sources can be broken down into five: carbon dioxide (CO 2), sulphur dioxide (SO 2), hydrocarbons (HC), particulate matter, and nitrogen oxides (NO X).

1) Carbon monoxide is an invisible ordourless and tasteless gas, formed when any carbon-containing fuel, such as gas or coal, is not completely burned to carbon dioxide (CO 2). The internal combustion engine in motor vehicles, primarily cars, is the main source.

Carbon monoxide is not known to have an adverse effect on vegetation, visibility or material objects. In man, however, it passes directly from the lungs into the blood stream where it combines with the red blood cells hemoglobin, which normally carry oxygen to all the tissues of the body. Because the heart and the brain are very sensitive to oxygen deprivation, they show the most serious effects from prolonged carbon monoxide exposure.

2) Sulphur oxides, in combination with moisture and oxygen, can yellow the leaves of plants, dissolve marble, eat away iron and steel, limit visibility, cut down light from the sun, and affect man's breathing by injuring lung tissue.

Sulphur is a non-metallic element found in coal and fuel oil. The major source of this pollutant is fuel combustion. When the fuel is burned, the sulphur joins the oxygen in the air to form gaseous oxides of sulphur. Minor sources are chemical plants, metal processing, and trash burning.

3) Hydrocarbons stem from the internal combustion engines in motor vehicles, primarily the auto, and from the evaporation of organic solvents (from such operations as painting and dry cleaning), agricultural burning, and gasoline marketing.

By themselves, hydrocarbons do not display any adverse human effects, however, in the presence of sunlight and oxides of nitrogen, a chemical reaction takes place and they become photochemical oxidants.

In addition to creating smog, photochemical oxidants can directly affect lungs and eyes, can harm plants, and weaken such materials as rubber and fabrics.

Certain specific hydrocarbons do have other effects. Ethylene, for example, damages plants.

4) Particulate matter are those pollutants which are visible, such as soot, dust, fly ash, and asbestos particles.

Hydrocarbons, which stem from car engines, can create smog and irritate eyes and lungs.

These cause the greatest part of visible pollution in urban areas such as damage to buildings and plant life, smog, and poor visibility.

5) Nitrogen gas, normally a relatively inert (unreactive) substance, comprises about 80 per cent of the air around us. It can combine with oxygen, under certain conditions, to form several gaseous compounds collectively called oxides of nitrogen.

The major source is again through fuel combustion.

Oxides of nitrogen can cause serious injury to vegetation, fading or deterioration of fabrics, and can reduce visibility.

Certain members of this family are known to be harmful to men and animals. Exposure to high levels can cause respiratory problems.

Controlling Air Pollution

There are several methods for controlling or reducing air pollution. Naturally, the most preferred and effective way is to reduce the amount or rate of emissions at source.

However, meteorological forecasting can also be of assistance. Wind direction and speed, turbulence, temperature and atmospheric stability (the rate at which temperature changes with height) all play a part in determining how badly an area will be affected by air pollution.

For example, wind, or the lack of it, affects movement and dispersion of pollutants. Rainfall washes many pollutants from the atmosphere. Humidity in the air has an important bearing on how pollutants affect building, vegetation, and human health. Sunshine produces photochemical changes in air pollutants which form smog.

By using meteorological forecasts, the Ministry of the Environment can see when a build-up of pollutants causing a hazard to health might occur and can advise industries to temporarily reduce or shut down their operations until weather conditions change.

This arrangement in Ontario is called the air pollution index and alert system and was established in 1970. The pollution index readings are released to the public four times daily through the news media.

Another method to control air pollution is to raise the height of an industry's chimney or stack so that the ground level concentrations of sulphur dioxide are reduced by dispersal into the atmosphere.

This method, however, can only be regarded as an interim step. The ultimate solution for air pollution problems lies in the reduction of emissions of contaminants, not just the control of ground level concentrations.

Additional Reading

Introduction to Air Pollution in Ontario (fact sheet). Ministry of the Environment.

How Air Pollution Affects Vegetation (fact sheet). Ministry of the Environment.

Air Pollution Index (fact sheet). Ministry of the Environment.

The following booklets are also available free of charge from your nearest Lung Association Office:

Air Pollution's Harmful Health Effects (fact sheet)

It's Your Problem — Air Pollution

Air Pollution Explained: What You Can Do

Air Pollution Explained: The Pollutants

Air Pollution Primer

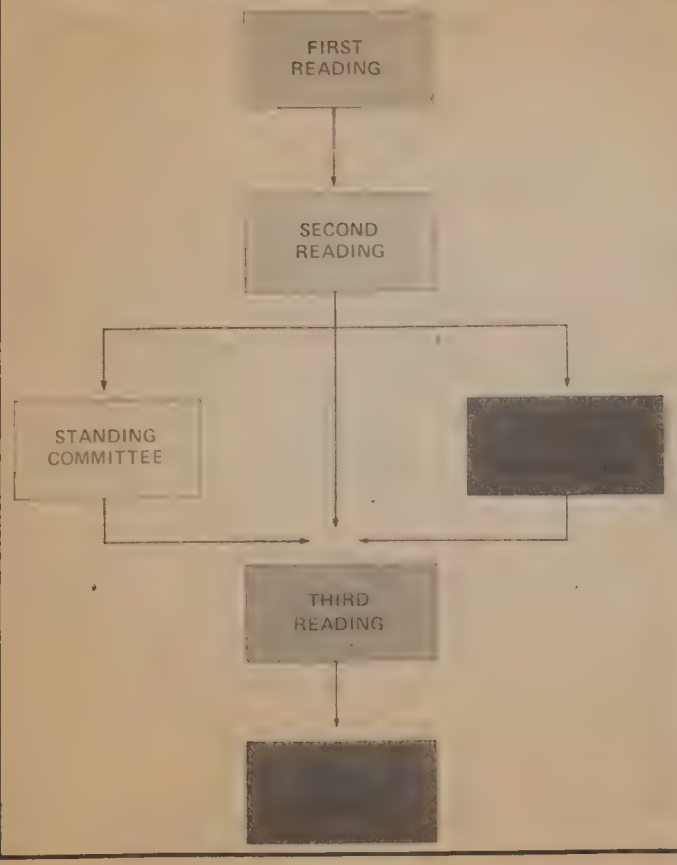
Don't You Dare Breathe That Air

Enemies in the Dust

Controlling Air Pollution A Primer on Stationary Source Control Techniques

Breathing...what you need to know

The legislative process - *(Continued from page 8.)*



bers of the public and ministry officials may attend and participate at the request of the Committee. After consideration, the Bill must be reported back to the House or referred to the Committee of the Whole House. (Standing Committees are formed by each government and have proportionate representation by Party.)

The procedure before the Committee of the Whole House is similar, except the debate is held in the Chamber of the House and there is no opportunity for public participation. Debate is informal and amendments may be made.

At third reading, debate is limited to procedure in a brief summing up of the legislation. The minister responsible does not normally make a speech at this point.

The Lieutenant Governor signs the Bill on behalf of the Queen and it becomes an Act. The proposed legislation becomes law.

Regulations, which make details in the Act more specific, are made at a later date by civil servants employed by the Ministry involved. They do not need parliamentary approval.

Copies of provincial acts may be obtained through the Ontario Government Bookstore. New regulations to the acts are published in the Ontario Gazette. Copies of the Gazette can be found in most public libraries.

Water treatment
From lake to doorstep

The Ontario Ministry of the Environment is the Ontario government agency responsible for the management of water resources throughout the Province of Ontario.

As part of the water management function, the Ministry keeps close check on the quality of all municipal water supplies, and builds and operates water treatment plants and facilities for municipalities and areas.

The following is an outline of the treatment method and equipment used to purify surface water for community use. This type of treatment is typical for larger communities. There are a number of other methods for smaller applications.

The object of treatment is to use the most effective processes and equipment for the removal of impurities inherent in a specific source, and to render the water odourless, colourless, free from undesirable chemicals and bacteriologically safe.

Intake

To obtain water from a surface source, an intake crib is built in deep water some distance from the shore. From the intake crib an intake pipe carries the water to a low lift pumping station located on the shore. Screening devices across the intake and within the low lift station prevent entry of fish and other objects. The screened water is then pumped to the treatment plant.

Microstrainer

Where there is a relatively large amount of algae in the raw water, it may be screened again. The screening unit, called a microstrainer, is a revolving drum covered on the outside with a finely woven stainless steel cloth.

The raw water enters the centre of the drum and passes out through the screen cloth, which entraps algae and other foreign materials The strainer is continuously backwashed to remove the accumulated impurities, which are discharged to a waste hopper.

Flocculation and Sedimentation

From the microstrainer, the water flows to a large concrete tank called a "flocculator". This is a chamber designed to allow for the intermixing of chemicals and water to coagulate the impurities contained in the water together for easy removal in the settling basin following.

The coagulating chemicals, such as alum, are added automatically by chemical feeders which operate in relation to the flow entering the flocculator. The tank contains large paddles which constantly agitate the contents to prevent settling.

From the flocculators the water passes into a sedimentation (settling) basin where it is retained for a period to allow the accumulated clusters (floc) time to settle to the bottom for removal and disposal.

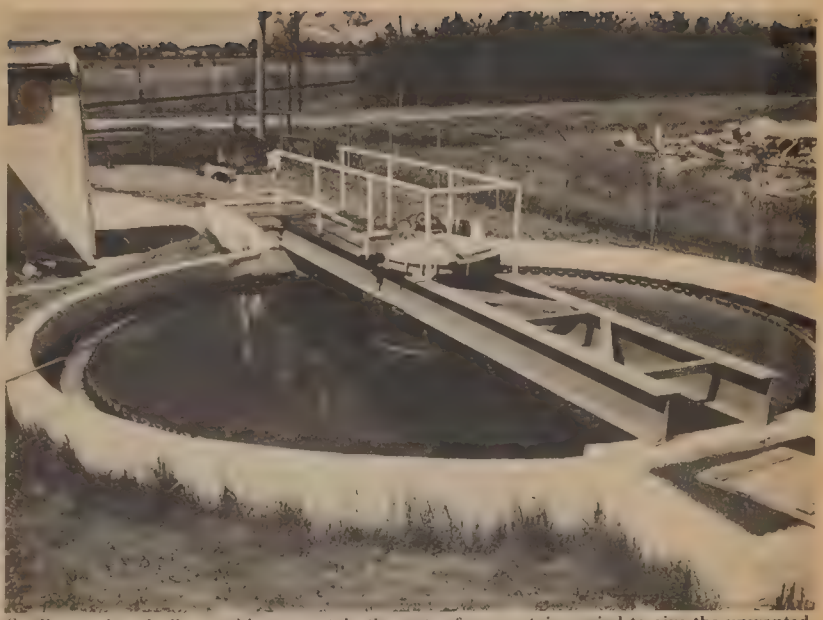
Sand Filters

The partially treated water then passes into the filtering stage, which consists of gravity filters.

The filters are concrete tanks into which have been placed straining systems, called the filtering "media". The media consist of layers of finely graded sand or anthracite coal over layers of graded gravel which rest upon an underdrain system of perforated pipes.

In the filtering operation, the partially treated water flows over the top of the filter media and passes down through to the underdrains and out into a clear water reservoir. Impurities contained in the water are trapped in the media.

Periodically, the filters are taken out of service and backwashed by forcing clean water up through the media at a high rate. The accumulated impurities are scoured out from within the sand layer into wash water troughs and discharged to a waste sewer.



Settling tanks, similar to this one, retain the water for a certain period to give the unwanted materials, it carries, time to settle to the bottom for removal and disposal.

Chlorination

The purified water accumulates in a clear water reservoir where it is chlorinated to ensure complete disinfection before discharge to the community.

The chlorine is fed automatically in proportion to the flow entering the reservoir and its level of concentration is so low that it would not constitute a safety risk even to an infant.

Laboratory Facility

It is vital that a constant check be kept on the quality of the water in process and leaving the plant.

This is done by the operating staff in the plant laboratory where every aspect of treatment and final delivery is closely watched and analyzed.

This ensures the highest quality possible for delivery to the consumer.

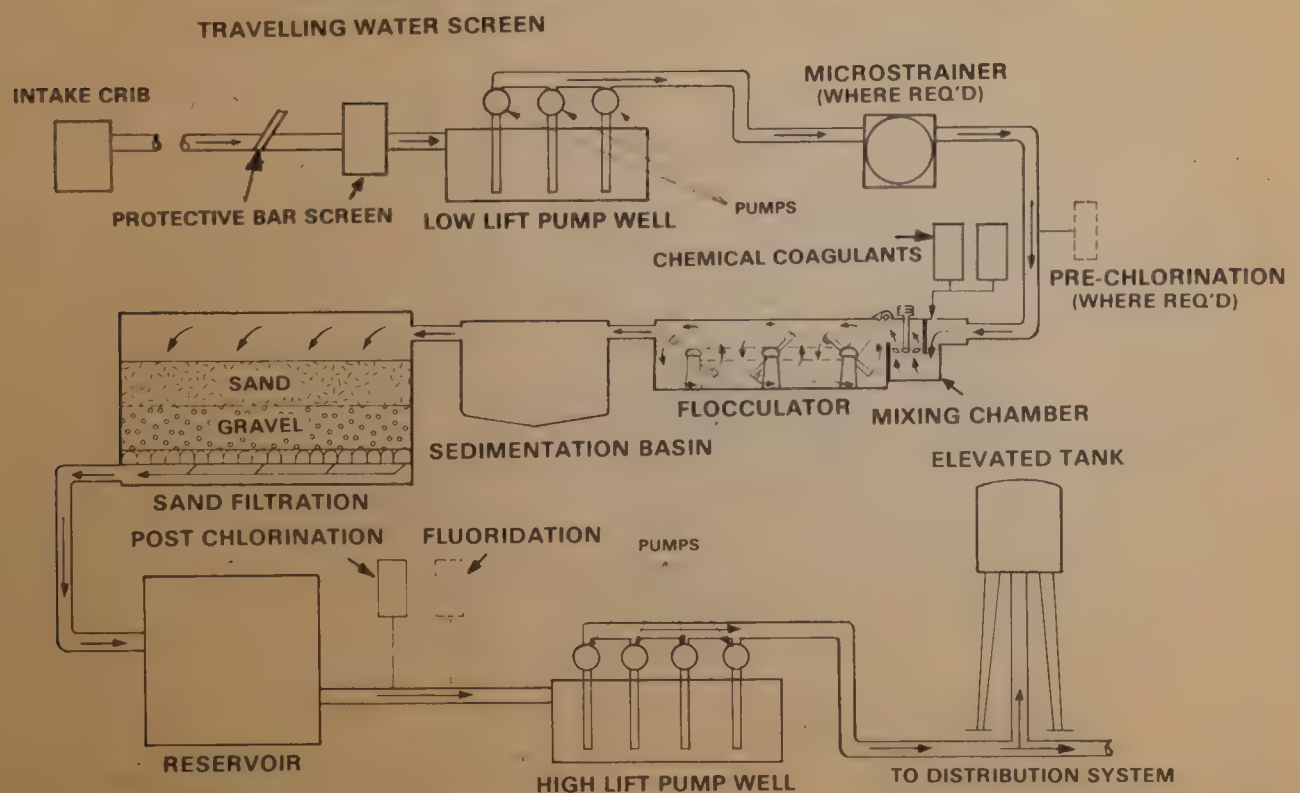
Plant Operation

Water treatment plants, as described here, and smaller installations, are staffed by specialists in the field of plant operations throughout Ontario.

A visit to a local plant to see what is being done to provide safe drinking water for your community is suggested.

Additional information on the operation and maintenance of a water treatment plant may be obtained from the superintendent of the Environment Ontario or municipally operated plant in your area.

WATER TREATMENT PLANT FLOW DIAGRAM



Nuclear Power

Water disposal facilities under study

In Ontario, roughly 27 per cent of our electricity is produced by nuclear power. In fact, one of the world's largest nuclear power stations — the Pickering Generating Station — is located on the shore of Lake Ontario near Toronto.

The main ingredient in this type of energy production is uranium, one of the world's few natural radioactive substances. Uranium has a very slow rate of decay. Its half-life is 4.5 billion years. Most of Canada's known reserves are found in the Canadian Shield.

Radioactivity

Like all radioactive materials, uranium sends out millions of high-energy particles that penetrate living plant and animal cells damaging or killing them. It can cause brain disease, cancer, leukemia, skin lesions, accelerated aging and genetic damage. Large radiation doses can kill quickly but the long-term effects of low levels are less understood.

Except for the men and women working in nuclear industries, few people come near large sources of direct radiation. The average Canadian absorbs an annual average whole-body dose of about 100 millirems from natural radiation sources, such as the radiated energy from the sun and cosmic rays from outer space, and an additional 35 millirems from medical sources.

Nuclear energy currently exposes the public to an annual dose of about .003 millirem. This could rise to about 5.7 millirems per year with the expansion of nuclear power during the next couple of decades. Of this, about 1.5 millirems will be received by the public and about 4.2 by nuclear workers.

The federal corporation, Atomic Energy of Canada Ltd. (AECL), has estimated that the biological damage caused by that 5.7 millirem per year would be about equal to that caused by one cigarette a year. Without proper care, however, serious environmental problems could result during the nuclear cycle.

Nuclear Cycle

Before a nuclear reactor can be started up, uranium must first be mined, then refined, and then processed into a form that can be used as fuel. After about nine months to a year of operation, part of the fuel must be removed from the reactor and reprocessed.

Each of these steps produces some radioactive wastes. The key concern in recent years is the safe disposal of these materials. Some are so deadly that they must be stored away for thousands of years to prevent them from entering the environment.

For the past ten years, since the production of electricity from nuclear energy began, the irradiated fuel (the term given to uranium fuel bundles after they have been used in a fission reaction in a nuclear reactor) has been stored under water at the Ontario Hydro generating stations on an interim basis. This temporary method is common world wide and is agreed to be a safe method for several decades.

Supervision

In Canada, the Federal Government, through the Atomic Energy Control Board, has legal jurisdiction over all matters involving "prescribed substances" and nuclear facilities, in the interests of "health, safety and security". A licensing procedure is administered by the AECB, for the separate aspects of mining, production, refining, use, sale or possession of prescribed substances. These substances include uranium, thorium and plutonium.

A jurisdictional overlap appears to exist with regard to the licensing procedure outlined above, in that while the Ministry of the Environment grants Certificates of Approval for the facilities in accordance with its standards and criteria, only the AECB, through its licensing procedure, has the ultimate power to ensure compliance.

Nevertheless, the Ministry of the Environment reviews applications on some aspects of generating stations, such as the spent fuel storage bays. The Ministry frequently questions Ontario Hydro on technical aspects of such installations, in an attempt to understand safety and integrity aspects, as well as to determine the possibility of potential releases.

However, the various levels of government are also looking for new permanent storage facilities.

Permanent Facilities

The federal Department of Energy, Mines and Resources, the AECL are working with the Ministry of Energy and Ontario Hydro to ensure the development of safe disposal facilities in this Province for radioactive wastes from nuclear power reactors.

Under this new long-term program, which was announced in June of 1978, the Government of Canada will undertake research and development in the immobilization and disposal of radioactive wastes, while the Government of Ontario will similarly be responsible for studies on interim storage and transportation.

The immobilization research and development will be performed in the laboratories of Atomic Energy of Canada Ltd. It will cover theoretical and experimental studies for treating the residues from the reactor fuel cycle so as to produce stable insoluble products for eventual disposal in an underground repository.

The purpose of the disposal research and development studies is to verify that permanent disposal in a deep underground repository in intrusive igneous rock is a safe, secure, and desirable method of disposing of radioactive waste. This will involve geological field parties collecting surface samples and examining other surface features in various parts of the Province, to determine the full range of chemical and physical properties of rock formations expected to be suitable for a waste disposal facility. The two governments have agreed that field work should commence in Ontario in 1978. To develop appropriate test equipment, procedures and information on a variety of rock types, experimental drilling will be conducted this year at the laboratores of AECL. Further drilling of this type, at mutally agreed sites, to depths of about 1,000 metres will be carried out at six to ten other locations in 1979-80.

The research and development studies are directed towards an evaluation of a series of barriers to prevent the release of radioactivity to the environment. An analysis will be made of their effectiveness based upon information derived from the immobilization research and development and the geological studies described above. This information will be used to classify the 1,500 or more potentially suitable geological formations which are known to exist in Ontario.

The tentative schedule being used for planning purposes is:

1978-1980 — Geological survey work, experimental drilling and accelerated research and development.
1981-1983 — Site selection for demonstration repository.
1983 — Site Acquisition.
1985-2000 — Disposal demonstration.
2000 and beyond — Full-scale facilities operational.

Advantages

Although the use of nuclear power can be extremely dangerous, it does have clear advantages over coal and fuel.

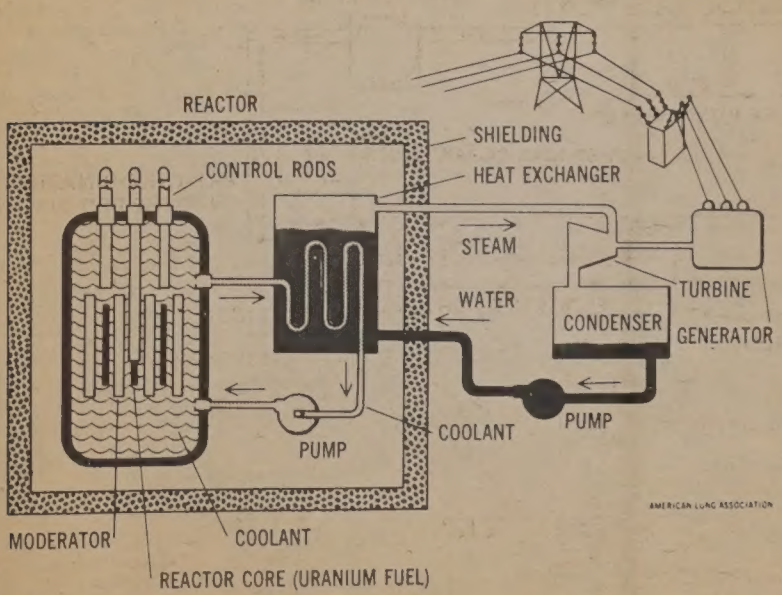
It does not pollute the atmosphere because the radioactivity is carefully contained. Secondly, nuclear plants may be located almost anywhere without regard to the distance from the fuel sources. And thirdly, the amount of uranium fuel needed to keep a nuclear reactor in operation is so small that transportation costs can almost be disregarded.

For further information contact:

Atomic Energy of Canada Ltd.
Whiteshell Nuclear Research Establishment
Pinawa, Manitoba
R0E 1L0

Ontario Hydro
Northwestern Division
Room 304
34 Cumberland Street North
Thunder Bay, Ontario
R0E 4L5

Atomic Energy Control Board
P.O. Box 1046
270 Albert Street
Ottawa, Ontario
K1P 5S9



ENERGY PRODUCED IN A NUCLEAR POWER PLANT

Fission is initiated with the reactor and the power level is regulated by the manipulation of control rods; the fission process releases heat energy; the coolant absorbs the heat and carries it off to the heat exchanger where water is heated (without direct contact with the radioactive coolant) and becomes steam; the steam turns the turbine which rotates the generator to produce electrical energy that is the final product of the power plant. The radioactive coolant is recirculated in a closed loop for further use. The steam is condensed to water and the water, too, is recirculated. The moderators slow down the neutrons that bombard the fuel cores to produce more efficient absorption by the fuel.

Ministry offices

HEAD OFFICE

135 St. Clair Avenue West,
TORONTO M4V 1P5

Northwestern Region

Regional Office
P.O. Box 5000,
435 James Street South
THUNDER BAY P7C 5G6
475-1205

District Offices

P.O. Box 5000,
435 James Street South
THUNDER BAY P7C 5G6
475-1315

P.O. Box 5750,
808 Robertson Street
KENORA P9N 1X9
468-5578

Northeastern Region

Regional Office
469 Bouchard Street
Regency Mall
SUDBURY P3E 2K8
522-8282

District Offices

469 Bouchard Street
Regency Mall
SUDBURY P3E 2K8
522-8282

83 Algonquin Blvd. West
TIMMINS P4N 2R4
264-9474

445 Albert Street East
SAULT STE. MARIE
P6A 2J9
949-4640

1500 Fisher Street
Northgate Plaza
NORTH BAY P1B 2H3
476-1001

74 Church Street
PARRY SOUND P2A 1Z1
746-2139

Southwestern Region

Reginal Office
985 Adelaide Street South
LONDON N6E 1V3
681-3600

District Offices

6th Floor,
250 Windsor Avenue
WINDSOR N9A 6V9
254-5129

Suite 209S
242A Indian Road South
SARNIA N7T 3W4
336-4030

Suite 108
220 - 11th Street East
OWEN SOUND N4K 1T9
371-2901

435 Grand Avenue West
CHATHAM N7L 3Z4
352-5107

c/o Ministry of Agriculture
and Food
P.O. Box 688
CLINTON N0M 1L0
482-3428

West-Central Rgion

Regional Office
140 Centennial Parkway North
STONEY CREEK L8E 3H2
561-7410

District Offices

400 Clyde Road
P.O. Box 219
CAMBRIDGE N1R 5W6
623-2080

637-641 Niagara Street North
WELLAND L3C 1L9
735-0431

645 Norfolk Street North
SIMCOE N3Y 3R2
426-1940

Central Region

Regional Office
Suite 700
150 Ferrand Drive
DON MILLS M3C 3C3
424-3000

District Offices

12 Fairview Road
BARRIE L4N 4P3
726-1730

Hwy 11
GRAVENHURST P0C 1G0
687-3408

139 George Street North
PETERBOROUGH K9J 3G6
743-2972

150 Ferrand Drive
TORONTO M3C 3C3
424-3000

1226 White Oaks Blvd.
OAKVILLE L6H 2B9
844-5747

100 Main Street East
HUNTSVILLE P0A 1K0
789-2386

Southeastern Region

Regional Office
133 Dalton Street
P.O. Box 820
KINGSTON K7L 4X6
549-4000

District Offices

2378 Holly Lane
OTTAWA K1V 7P1
521-3450

2nd Floor
4 Montreal Road
CORNWALL K6H 1B1
933-7402

15 Victoria Avenue
BELLEVILLE K8N 1Z5
962-9208

P.O. Box 67
1000 MacKay Street
PEMBROKE K8A 6X1
732-3643

One method of disposing of sewage sludge is to spread it on agricultural land as a soil conditioner.

Sewage sludge research continues due to Provincial Lottery Funding

Sludge is the solid matter removed from wastewater during the sewage treatment process. It is usually disposed of in a landfill site or it can be used as a soil conditioner.

Environment Ontario has long been concerned, however, with the effect of this sludge on agricultural land and on the unknown long-term environmental effects of the heavy metals and nitrogen, which the sludge contains.

Fortunately, two on-going research projects, which are evaluating the environmental impact of sewage sludge on agricultural land, have received money to continue their work through the Provincial Lottery Funding Program.

The University of Guelph was awarded a $110,315 contract allowing a one-year extension of its study of the long-term effects of sewage treated land on the yield and quality of crops. This project places particular emphasis on the study of heavy metal uptake in crops by utilizing greenhouse and field studies which began in 1972.

The second contract was awarded to Rush Engineering Services Limited of Listowel, Ontario and studies the maximum long-term sludge loadings for various soil crop systems. This investigation will be conducted by monitoring the quality of crops, leachite, and soil through the use of lysimeter equipment at Environment Canada's Wastewater Technology Centre in Burlington, Ontario.

Unlike the Guelph University contract, which is completely funded by the Provincial Lottery, the Rush Engineering contract funding is shared equally by the provincial and federal governments with Ontario's half covered by $35,100 in Provincial Lottery Funds.

The projects were originally initiated by the Canada/Ontario Agreement on Great Lakes Water Quality and received their funding from this source until the research funding ran out in the 1977-78 fiscal year.

Additional Reading

Sensible Sludge — A New Look at a Wasted Natural Resource, Jerome Goldstein, 1977. Rodale Press, Emmaus, PA. $7.25.

Accumulation Rate and Characteristics of Septic Tank Sludge and Seepage (technical Report). 1977. Ministry of the Environment.

Mining - *(Continued from page 8.)*

water can be handled in at least one of the following ways:
(i) The mine water can be directed to the mill for reuse; or
(ii) the mine water can be directed to the tailings area; or,
(iii) the mine water can be collected and treated by itself.

All three methods are presently being used in Ontario.

Secondary Effluent Control

There are only two basic secondary effluents that arise as a result of Ontario mining practices. These are as follows:

(1) tailings area (and waste rock storage area) seepage and
(2) tailings area overflow.

In Ontario, the overflow from a tailings area generally presents a large volume liquid waste treatment problem. Calculations show that in 1971 the hardrock mines of Ontario generated an average decant flow of 800 Imperial gallons per day per ton ore milled.

Government Control

The actual physical and/or chemical treatment of tailings area overflows varies, as might be expected, from property to property. The subject of effluent control in the Ontario mining industry is covered in detail in two separate reports, both of which are available free-of-charge from the Ontario Ministry of the Environment. The first report is entitled "The Problem of Acid Mine Drainage in the Province of Ontario — 1972". The second is entitled "Use, Characteristics and Toxicity of Mine-Mill Reagents in Ontario — 1972". Together, these two reports describe in detail the advantages and disadvantages of most of the mine waste treatment techniques that find use in Ontario.

Under The Ontario Mining Act the revegetation and/or stabilization of unused mine tailings areas is mandatory within the boundaries of the Province. As a result, under a variety of conditions, hundreds of acres of abandoned tailings have been successfully revegetated.

Environmental control is only one of the many problems that the mining industry must face today. Present technology, however, is such that many environmental problems have been defined but few have been completely solved. It is, therefore, necessary for the public, the government, and the industry to work together to achieve satisfactory control of pollution problems arising from mining operations.

Ministry of the Environment
Ontario

1979 International Year of the Child

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Director .....R.J. Frewin
Editor .....Jane Watson
Educational Resources Co-ordinator .....M.F. Cheetham